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MUNGOMERY (R. W.). **Report of the Division of Entomology and Pathology.**—*47th Rep. Bur. Sug. Exp. Stas Qd 1946–47* pp. 35–45. Brisbane, 1947.

Dry weather that began in Queensland towards the end of the previous growing season caused drought conditions during much of the season in 1946–47, and injury to sugar-cane by pests was not severe. The expected outbreak of *Dermolepida albohirtum*, Waterh., in the north [*R.A.E.*, A **35** 366] was prevented, but there was some light damage in May and June. In view of the satisfactory control given by BHC (benzene hexachloride) in the previous year [**35** 367], its effect on sugar-cane was investigated. A 10 per cent. dust (containing 1·3 per cent. γ isomer) applied to the surface of the soil at rates of 50–600 lb. (0·65–7·8 lb. γ BHC) per acre and subsequently worked in with various cultivating implements under a wide variety of climatic conditions caused no perceptible damage; in another test in which the rates varied from 100 to 1,000 lb. per acre, the highest rate caused initial stunting, which later became less apparent. Since the higher rates tested greatly exceed those required for control, it is unlikely that the cumulative effects of successive applications would be injurious. It was found that γ BHC mixed with soil at a rate of one part per million gave 50 per cent. mortality of the adults in three days. The results of experiments in which the dust was applied at rates of 12½–600 lb. (0·16–7·8 lb. γ isomer) per acre on dates extending from six months before beetle flight to two months after it against the larvae were mostly inconclusive, owing to the light infestation; in cases where the control plants were damaged, rates as low as 50 lb. per acre gave very good results, though they did not prevent some early damage, and 100 lb. per acre appeared to be safe and effective. Applications made prior to beetle flight gave the best results; applications made one month after it gave partial control, but were followed by sufficient damage to render this timing hazardous, and those made two months after it were of no value. Broadcasting the dust when the cane had sprouted appeared to be as effective as applying it in a band about 18 ins. wide along the drill, and, provided that this method does not entail any undue increase in the rate of application, it may be advantageous in destroying either the adults leaving or entering the soil or the young larvae. On the basis of these tests, an application of 100 lb. dust per acre, made as a drill dressing and worked into the soil one or two months before beetle flight is expected, is tentatively recommended; the cost of the treatment is about half that of fumigation with carbon bisulphide.

Larvae of *Lepidiota frenchi*, Blkb., which damaged young cane in several parts of the north, and *L. consobrina*, Gir., which caused severe damage on clay soil, require two years for their development, and were less affected by the drought. A few severe, localised attacks by larvae of *L. trichosterna*, Lea, occurred in the Bundaberg district; here and at Isis, infestation by *Pseudoholophylla furfuracea*, Burm., was lighter than usual, and except in irrigated areas, losses due to it were nullified by the general failure of most crops owing to the drought. Adults of *L. frenchi* caged in soil treated with BHC were killed by a concentration of one part γ isomer per million, but the larvae of both this species and *L. consobrina* appeared to be more resistant than those of *D. albohirtum*.

Wireworms (*Lacon variabilis*, Cand.) were abundant in some fields in the Mackay district, but did not cause extensive damage. Field trials of their control by means of BHC [*cf.* **37** 281] showed that the 10 per cent. dust mixed with the amount of fertiliser normally used on plant crops and applied at a rate of 20 lb. (0·26 lb. γ isomer) per acre in a band immediately above the setts gave 95 per cent. protection and did not appreciably damage the roots.

Poor stands overgrown with grass and weeds in the Cairns district became infested with *Locusta migratoria*, L., in June. Hoppers of all instars and adults

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were present, and nearly all the locusts were in the gregarious phase, but they later spread out and fed on self-set and newly sprouted cane without damaging it much. Eggs were laid towards the end of June, but the locusts that developed from them were of the solitary phase. A dust containing 1·5 per cent. γ BHC applied to a small area on which the hoppers were dense gave very effective mortality. Small swarms of *Oedaleus australis*, Sauss., appeared in a district in south Queensland, but did not become of importance, and *Gastrimargus musicus*, F., was even less abundant than in the previous season [**35** 367] and caused no damage to sugar-cane.

The Noctuid recorded on sugar-cane in 1946 as *Mocis trifasciata*, Steph. [**35** 368] has since been identified as *M. frugalis*, F., and the parasites reared from it in that year as *Sarcophaga peregrina*, R.-D., the Tachinids, *Actia nigritula*, Mall., *Tricholyga sorbillans*, Wied., and *Carcelia kockiana*, Tns., the Chalcid, *Brachymeria* sp., and the Ichneumonids, *Enicospilus* (*Henicospilus*) sp., and *Lissopimpla semipunctata*, Kby. It was very abundant in the Ingham District during April–May 1947, when the larvae defoliated cane over an area of more than a thousand acres. The damage was greatest in rather light crops with thick grass between the rows, as the larvae hatched and fed on the grass before migrating to the cane. The loss in yield was not great, but it was difficult to harvest the crop early in the season, since, owing to the loss of foliage, there was little dry trash to provide a satisfactory pre-harvest burn. The outbreak was quickly controlled by parasites, which were similar to those reared in 1946, and some of the larvae were killed by the Pentatomid, *Austromalaya souefi*, Dist., or carried away by *Sphex clavus*, F.

Coptotermes acinaciformis, Frogg., was reported on sugar-cane in several places in the north, but was of importance in only one field, where growing canes of P.O.J.2878 were completely hollowed and the injury resembled that normally due to *Mastotermes darwiniensis*, Frogg., in the Ayr district. *Hamitermes obtusidens*, Mjöberg, caused considerable damage to isolation plots, and *Rhinotermes intermedius seclusus*, Hill, attacked cane slightly at Aloomba.

Tetranychus sp. was more abundant than usual on cane leaves as a result of the dry season ; the variety Trojan appeared to be preferred by it.

MINISTRY OF AGRICULTURE AND FISHERIES. **Destructive Insects and Pests Acts, 1877 to 1927. Importation of Plants Orders of 1947 and 1949, General Licence (I.P. Gen. 2/1949).**—2 pp. multigraph. [London] 24th November, 1949.

A list is given of a large number of plants and a few vegetables that may be imported into England or Wales from Europe, the United States or Canada during the whole or part of the year under specified conditions [*cf. R.A.E.*, A **35** 194].

THOMAS (I.). **Injury to Aster Seedlings by the Leaf-curling Plum Aphis (*Anuraphis helichrysi* Kalt.).**—*J. R. hort. Soc.* **72** pt. 9 pp. 369–370, 1 pl. London, 1947. **Errata.**—*T.c.* pt. 11 p. 460.

Seedling asters exhibiting a typical form of crinkling that is often troublesome in nurseries in England were received in June 1946 and found to be infested by a few examples of *Anuraphis padi*, L. (*helichrysi*, Kalt.) feeding in the folds of the very young leaves and small numbers of *Macrosiphum solanifolii*, Ashm., and *M.* (*Aulacorthum*) *solani*, Kalt. In experiments to ascertain whether these were the cause of the injury, batches of each of the three Aphids from the affected plants were caged separately on healthy aster seedlings on 19th July, and others were similarly infested with *A. padi* from chrysanthemum. Two

plants were left as controls. Some of the plants became accidentally infested by *Thrips tabaci*, Lind., which caused typical thrips injury. By 24th July, *A. padi* was reproducing in the young folded leaves in the centres of the plants, and the other two Aphids were more scattered. The cages were removed on 31st July. Typical crinkling of the leaves developed on the plants infested by *A. padi*, but not on the controls, and similar, but milder, symptoms appeared on those infested by the other two Aphids. By 1st September, the Aphids had been destroyed by natural enemies, and the young leaves were normal; a similar recovery has been noted in nurseries. It is concluded that *A. padi* was chiefly responsible for the injury, and though other species can produce similar symptoms, they are unlikely to be so severe unless caused by an Aphid that feeds in the young, folded leaves. The findings are supported by the unpublished results of experiments made by Sir J. Fryer 15–20 years ago, in which plants dipped in nicotine solution and sprayed remained free from symptoms, while those not so treated developed crinkle.

To prevent the damage, aster seedlings should be sprayed with nicotine before the symptoms appear or fumigated with nicotine under glass.

Birch (L. C.). **The intrinsic Rate of natural Increase of an Insect Population.**—*J. Anim. Ecol.* **17** no. 1 pp. 15–26, 34 refs. London, 1948.

The following is virtually the author's summary. The parameter known as the intrinsic rate of natural increase, which was developed for demographic analyses by A. J. Lotka, is introduced as a useful concept for the study of insect populations. It is suggested that, for the sake of uniformity of terminology in population biology and for precision of definition, the term "intrinsic rate of natural increase" might be considered more appropriate than an alternative term "biotic-potential", which is more frequently used in relation to insect populations. The intrinsic rate of natural increase is defined as the exponent "r" in the exponential equation for population increase in an unlimited environment. The rate of increase of such a population is given by $dN/dt=rN$. The parameter r refers to the rate of increase of a population with a certain fixed age distribution known as the stable age distribution. Both the intrinsic rate of natural increase and the stable age distribution may be calculated from the age-specific survival rates (life table) and age-specific fecundity rates. The methods of calculation are exemplified with data for *Calandra oryzae*, L., and some adapted for it from *Tribolium confusum*, Duv. It is shown in this example that the intrinsic rate of natural increase is determined to a much greater extent by the rate of oviposition in the first two weeks of adult life than by the total number of eggs laid in the entire lifetime. The oviposition rates in the first two weeks account for 85 per cent. of the value of r, whereas only 27 per cent. of the total number of eggs are laid in that time. With each successive week in the life of the adult, eggs laid make a lessened contribution to the value of r. The methods of calculation of r provide a means of determining the extent to which the various components—the life table, the fecundity table, and the length of the pre-reproductive stages—enter into the value of r. It is suggested that analyses of this sort may provide a clue to the life patterns characteristic of different species.

The importance of the age distribution of populations that initiate seasonal increase in the autumn and spring is discussed. These age distributions depend on the nature of the overwintering or oversummering stage. It is suggested that this particular stage, whether it be adult, larva, pupa or egg, has been selected by virtue not only of its resistance to the unfavourable season, but also in relation to its merits in initiating rapid establishment of a population in the succeeding season.

It is shown how the value of *r* for *C. oryzae* varies with the temperature. Four other parameters are also defined : the net reproduction rate, the mean length of a generation, the infinitesimal birth-rate and the infinitesimal death-rate. The methods of calculation of these parameters are also exemplified with data for *C. oryzae*.

AGENJO (R.). *Euzophera pinguis* (**Hw.**) **no citada de España y de la que es nueva sinonimia** *E. nelliella* **Rag., plaga del olivo en Níjar (Almería) (Lep. Cramb.).** [*E. pinguis*, not cited from Spain, has as a new Synonym *E. nelliella*, a Pest of Olive in Níjar.]—*Eos* **23** pt. 1 pp. 34–38, 1 pl., 14 refs. Madrid, 1947.

The author compared the genitalia of moths in his collection from various parts of Spain that had been identified by Meyrick as *Euzophera pinguis*, Haw., with those of specimens from El Escorial at the Institute of Entomology of Madrid identified by Schmidt of Budapest as *E. nelliella*, Rag., and two males reared from larvae on olive in Almería [*cf. R.A.E.*, A **35** 155] and found no differences between them. The original description of *E. nelliella*, which is quoted, is based on differences in coloration from *E. pinguis*, and the author retains the name for the form of *E. pinguis* that occurs in central and southern Spain, North Africa and Turkey, which he regards as a subspecies.

[POPOV (V. I.).] **Попов (В. И.). Vorrats-, Speicher- und Materialschädlinge in Bulgarien und ihre Bekämpfung.** [Pests of Provisions, Storehouses and Materials in Bulgaria and their Control.] [*In Bulgarian.*]—*Nauchn.-pop. R d. Bulg. Akad. Nauk* no. 5, 414 pp., 158 figs., 205 refs. Sofia, 1948. (With a Summary in German.)

This book on pests of stored products in Bulgaria is an enlarged version of one already noticed [*cf. R.A.E.*, A **28** 111] and is arranged on the same plan. It now deals with over 40 species of Arthropods, and sections on cheese and dried vegetables have been included.

[LAZAROV (A. V.).] **Лазаров (А. В.). Insect Pests of cultivated Fruits in Bulgaria and their Control.** [*In Bulgarian.*]—*Nauchn.-pop. Red. Bulg. Akad. Nauk* no. 8, 328 pp., 129 figs., 65 refs. Sofia, 1949.

This book consists of a short general section containing notes on the morphology and development of insects and the types of injury they cause, mechanical and chemical control measures, the composition, action and application of insecticides, spraying apparatus and the use of insectivorous birds, and a main section dealing with the individual species. The latter are grouped as polyphagous or as pests of the various pip and stone fruits, nuts, soft fruits and grape vines. The information given on each includes descriptions of the adults and in many instances of the immature stages, and notes on its biology, the injury caused, its importance in Bulgaria and appropriate measures of control.

SCHWERDTFEGER (F.). **Borkenkäfer-Bekämpfung in Fichtenwäldern. Eine Anleitung für den praktischen Forstmann.** [Control of Bark-beetles in Spruce Forests. A Guide for the practising Forester.]—38 pp. Hanover, M. & H. Schaper, 1948.

This booklet was written in view of the current outbreaks of bark-beetles in spruce forests in Germany and other parts of central Europe. The author describes the life-history of *Ips typographus*, L., the principal species concerned

in damage to living trees, and states that outbreaks are due to mass breeding in fallen or felled wood that has not been barked, so that sufficient beetles are present to overcome the resistance of healthy trees, expressed through resin flow, followed by favourable weather. They can be prevented by barking or removing all fallen or felled trees, and controlled or mitigated by a combination of winter and summer measures. The winter measures are the treatment of all lying trees, either by sprays or by barking, combined with burning the bark removed or spraying or dusting the ground under the tree with a contact insecticide [*cf. R.A.E.*, A **37** 65–66] ; felling and similarly treating infested standing trees ; and treating infested ground litter with carbon bisulphide or crude oil. Summer control measures comprise felling sufficient trap-logs to attract the whole of the emerging population, the number of logs to be calculated by a process analogous to one already noticed [**37** 66 ; *cf.* **38** 88], and barking them before the larvae have transformed or barking and burning the bark or spraying the logs if pupae or young adults are present, and spraying newly felled trap logs [*cf.* **37** 66].

VAN KOOT (H.) & WIERTZ (G.). **Onderzoek naar de afstervingstemperaturen van enkele voor de plantengroei schadelijke bodem-organismen.** [Investigations on the lethal Temperatures of several Soil Organisms harmful to Plant Growth.]—*Tijdschr. PlZiekt.* **53** pt. 5 pp. 121–133, 6 graphs, 12 refs. Wageningen, 1947. (With a Summary in English.)

In view of the lack of knowledge as to the temperatures and periods of exposure required to kill soil pests in the steam sterilisation of greenhouse soil, experiments were carried out in Holland with various soil organisms, including wireworms of the genus *Agriotes*. These were of various sizes and were kept in soil in test-tubes with slices of potato as food. The tubes were submerged for various periods in water at different temperatures and mortality noted 24 hours later. The results are shown on a graph, which indicates that complete mortality was given by exposures ranging from ten minutes at nearly 50°C. [122°F.] to three hours at 40°C. [104°F.]. Many of the other organisms required higher temperatures.

DE FLUITER (H. J.) & ANKERSMIT (G. W.). **Gegevens betreffende de aantasting van bonen (*Phaseolus vulgaris* L.) door de zwarte bonenluis (*Aphis (Doralis) fabae* Scop.).** [Data on the Infestation of Beans by *A. fabae*.]—*Tijdschr. PlZiekt.* **54** pt. 1 pp. 1–13, 3 figs., 2 graphs, 10 refs. Wageningen, 1948. (With a Summary in English.)

In the course of experiments in Holland in which young fundatrices of *Aphis fabae*, Scop., were transferred to beans (*Phaseolus vulgaris*) from *Euonymus*, it was observed that many of the Aphids became entangled in the hairs of the leaves of the variety used and died [*cf. R.A.E.*, A **35** 147]. This mortality was further investigated in tests with Aphids transferred from broad beans (*Vicia faba*) to various varieties of *P. vulgaris* and plants growing under wet and dry conditions. There were great differences in the mortality on the different varieties (which ranged from 24 to 100 per cent. in one test and 3·5 to 45·6 in another) and also on the same variety in different tests. The number of hairs per unit area on the leaves was somewhat greater for plants growing under dry conditions, though restricted leaf-growth might have accounted for this, but there were no significant differences in total mortality of Aphids under the two conditions. Mortality was significantly greater on the oldest

than on the youngest leaves of plants grown under dry conditions, and on the oldest leaves it was found to vary inversely with the starch content of the leaves, though this relation could have had no direct influence since the stylets of the Aphids were found to follow an intercellular course to the phloem.

Among natural enemies of the Aphid, Cecidomyiid larvae transferred to *Phaseolus* were also trapped by the hairs and died; larvae of *Coccinella septempunctata*, L., were trapped, but most of the older individuals were able to free themselves and left the plants. Adult Coccinellids were not affected. Larvae of *C. septempunctata* are common in colonies of the Aphid on broad beans, and they were frequently seen in the field on Aphid-infested *Phaseolus* beans that were also infested by *Tetranychus* sp., probably because the webbing of the mites facilitated their movements. Various other insects and a spider, a list of which is given, were also observed trapped on *Phaseolus* leaves.

DIERICK (G. F. E. M.). **Factoren welke van belang zijn bij de beoordeling van de mate der spintbestrijding door wintersproeimiddelen.** [Factors that are to be considered in the Evaluation of the Results of Red Spider Control by Winter Sprays.]—*Tijdschr. PlZiekt.* **54** pt. 3 pp. 81–85, 1 ref. Wageningen, 1948. (With a Summary in English.)

The following is based on the author's summary. In laboratory tests of sprays against winter eggs of the fruit-tree red spider [*Paratetranychus pilosus*, C. & F.] in Holland, it was found that these sprays retarded the hatching of the eggs that they did not kill. The same was observed when orchards were sprayed in winter. The effect was demonstrated more clearly when an oil emulsion with poor ovicidal properties was used. The hatching of the eggs on the sprayed trees was much delayed compared with the check trees, especially during the first period of hatching. If a count had been made only at this period, the kill of the eggs would have been estimated at 80–90 per cent. compared with the controls, but a count at a later date would have shown only 30–40 per cent. kill. This demonstrates the necessity of several counts if large mistakes are to be avoided. The delayed hatch seems to be due to the stage of development of the eggs at the time of spraying, and the more developed the eggs, the more sensitive they are [*cf. R.A.E.*, A **36** 129].

DE WILDE (J.). **Over de oorzaken der " resistentie " van** *Solanum demissum* **L. tegen de aantasting door de Coloradokever** (*Leptinotarsa decemlineata* **Say).** [The Causes of the Resistance of *S. demissum* to Attack by *L. decemlineata*.]—*Tijdschr. PlZiekt.* **54** pt. 3 pp. 90–94, 1 graph, 3 refs. Wageningen, 1948. (With a Summary in French.)

In view of the theory that the resistance of *Solanum demissum* to larvae of *Leptinotarsa decemlineata*, Say, is due to a toxic principle [*cf. R.A.E.*, A **28** 447, etc.] and the use of larval mortality to measure it, the results are given of tests in Holland in which larvae in all instars were confined on leaves of 14 strains of *S. demissum* at 20–25°C. [68–77°F.] and 96 per cent. relative humidity. They showed that feeding was considerable on 11 strains and that only three could be classed as resistant. When larvae in the second, third and fourth instars were confined with a resistant strain, they fed for only 24 hours and consumed very little. They showed no external symptoms of poisoning, however, and did not die more quickly than larvae kept without food, and the mortality curve of fourth-instar individuals was the same whether they had fed on *S. demissum* or had been starved. Larvae confined for 24 hours on a

resistant strain and then transferred to potato showed no higher mortality than those fed on potato only. It is concluded that the resistance of *S. demissum* is due merely to some factor that renders the leaves unpalatable to the larvae, and German workers are reported to have reached the same conclusion. The amount of leaf eaten would appear to be a better measure of resistance in this case than mortality.

VAN SCHREVEN (D. A.). **Onderzoekingen met betrekking tot enkele plagen en ziekten van Vorstenlandse tabak.** [Investigations on Pests and Diseases of Vorstenland Tobacco.]—*Tijdschr. PlZiekt.* **54** pt. 5–6 pp. 149–174, 7 figs., 30 refs. Wageningen, 1948. (With a Summary in English.)

Much of this report of work on pests and diseases of tobacco carried out by the Vorstenland Tobacco Experiment Station, Java, in 1940–42 is devoted to insects. With the outbreak of war in Europe, stored tobacco became a problem. Control of *Lasioderma serricorne*, F., by fumigation with carbon bisulphide did not give satisfaction, owing to alleged deterioration of flavour and aroma, and heat treatment was therefore tested. It was found that all stages of the beetle were killed when the room in which the bales were stacked was heated so that the temperature in the centre of the bales was maintained at 50°C. [122°F.] for five hours. Repeated heating resulted in breaking of the leaves in a dry atmosphere, but not in a humid one. An air temperature of 60°C. [140°F.] and a relative humidity of 65 per cent. are recommended. Fumigation with methallyl chloride at 8 fl. oz. per 100 cu. ft. for a period of three days gave complete mortality of all stages in most cases, provided that the fumigation chamber or room was gas-tight. Certificates for export to the United States were granted for tobacco fumigated with 10 fl. oz. for three days or 12 fl. oz. for two days. The flavour and aroma of the tobacco were not affected. A system of storage was evolved in which the stacks of bales in the storehouse were arranged in separate compartments that could be inspected and fumigated individually when necessary. An arrangement whereby adult beetles were attracted to a light and caught on adhesive was installed in each compartment and gave an indication of infestation.

Thrips identified as *Thrips* sp. [*cf. R.A.E.*, A **24** 668] injured cigarette tobacco of the Virginia type growing during the dry monsoon, but were successfully controlled by spraying with an extract prepared by soaking and pressing derris chips in water. This extract was made because of the scarcity of derris powder and was applied two or three times at fortnightly intervals at concentrations that had proved effective in the laboratory. Young tobacco plants growing near native tobacco were damaged by larvae of *Gnorimoschema heliopa*, Lower ; they were controlled by spraying with 2 or 5 per cent. derris powder (10 per cent. rotenone) every five days for a month, but a 1 per cent. spray was ineffective.

In addition to common tobacco mosaic, three types of distorting mosaic occur on Vorstenland tobacco. The virus causing green distorting mosaic, the most injurious type, is sap-transmissible and in experiments was transmitted by *Myzus persicae*, Sulz., from cucumber and *Capsicum annuum* to tobacco [*cf.* **27** 493] and from tobacco to Chinese cabbage, on which the symptoms were similar to those on tobacco. A mild form of distorting mosaic was transmitted from *Capsicum* to tobacco by *Aphis gossypii*, Glov. This Aphid is unable to survive for more than a few days on tobacco, but it is possible that infection may occasionally occur in the field when plantings of *C. annuum* are being broken up.

FIERO (G. W.). **Determination of Chlorine in DDT Insecticides.**—*Soap & sanit. Chem.* **23** no. 10 pp. 147, 149, 151. New York, N.Y., 1947.

Standard methods are proposed and described for determining the total chlorine in technical DDT, in dusting mixtures containing DDT in the presence and absence of organic matter such as colouring matter and plant resins, in mineral oil sprays containing DDT with or without organic matter such as plant extractive material from pyrethrum, derris or cubé or organic thiocyanates or both, and in emulsions containing DDT, water, solvent and emulsifying agent. They are applicable for DDT determination only when DDT is the sole source of chlorine in the product.

PICARD (J. P.) & KEARNS (C. W.). **Analysis of the essential structural Features of DDT by a Study of the Toxicity of closely related Compounds to Roaches and to Houseflies.**—*Canad. J. Res.* (D) **27** no. 2 pp. 59–67, 10 refs. Ottawa, 1949.

Läuger and his colleagues consider that the insecticidal action of DDT is due to the basic toxicity of the linked p-dichlorbenzene rings, which probably act by an enzyme-blocking mechanism, together with the action of the chloroform residue ($CHCCl_3$ group) as a lipophilic agent [*R.A.E.*, A **37** 330–331, etc.]. Others have attributed it to the ability of the chloroform residue to liberate hydrogen chloride at the site of action within the insect [**34** 255], which may be aided by the presence of a naturally occurring catalyst, or the spatial relationship of the different parts of the molecule. An attempt to provide further information on the relation between toxicity and chemical structure was made by comparing the toxicities of analogues in which the p,p′ substituent varied or was absent with those of the corresponding analogues in which the $CHCCl_3$ radical was replaced by C=O (benzophenones) or CHOH (benzohydrols), both of which are incapable of dehydrohalogenation. The methods of preparing the three groups of compounds are briefly indicated. The test insects were adult males of *Blattella germanica*, L., which were exposed for 96 hours to deposits from acetone solutions on the inner surface of glass containers, and house-flies (*Musca domestica*, L.), which were exposed in a test cage in a wind tunnel to 0·5 cc. kerosene solution of the compound under test drawn past them in the form of atomised droplets. The benzophenone derivatives showed no toxicity to *B. germanica*, even at very heavy deposits, and neither they nor the benzohydrols were effective against *M. domestica* at concentrations of 5 mg. per cc. Detailed results are given for the tests of the diphenyltrichlorethanes and benzohydrols against *B. germanica* and of the former against *M. domestica*. In tests with *B. germanica*, the median lethal deposits for DDT, its fluoro, bromo, methyl and methoxy analogues and its unsubstituted analogue were 1·15, 0·025, 3·4, 4·6, 3·2 and 15 mg. per sq. ft., respectively. The corresponding benzohydrol compounds showed similar toxicities, and it is therefore concluded that the presence of the $CHCCl_3$ group is not essential for insecticidal activity. In the tests with *M. domestica*, the median lethal concentrations for DDT and its fluoro, bromo, methyl and methoxy analogues were 0·17, 0·55, 0·28, 2·2 and 0·8 mg. per cc.: the unsubstituted analogue gave no mortality, and since the unsubstituted analogues were considerably less toxic than the others against *B. germanica*, substitution in the p,p′ positions appears to be necessary for insecticidal potency. The necessity for the substituents to be of limited size is illustrated by the high toxicity found for the p,p′-dimethyl and p,p′-dimethoxy compounds as compared with their next higher homologues. The loss in toxicity in the DDT analogues with increase in the p-alkyl or p-alkoxyl substituents indicates that enhanced paraffinic character is not beneficial even if it favours the oil-solubility of the product.

These results all support the conclusion that the electronegative character of the substituents and the lipophilic action of the $CHCCl_3$ group cannot alone account for toxicity, which must depend on the whole shape of the molecule. They also illustrate the importance of testing the toxicity of related compounds on insects of more than one species.

Müller (P.). **Ueber Zusammenhänge zwischen Konstitution und insektizider Wirkung. I. (Dichlordiphenyl-trichlor-äthan-Derivate und verwandte Verbindungen.)** [On the Relations between Constitution and insecticidal Action. I. (Dichlordiphenyltrichlorethane Derivatives and related Compounds.)]—*Helv. chim. Acta* **29** fasc. 6 pp. 1560–1580, refs. Basle, 1946.

This paper is a German version of one already noticed [*R.A.E.*, A **36** 274], expanded by the inclusion of results for all the five species of insects tested and a short section on derivatives of the diphenyltrichlorpropene group. Practically all the compounds were less effective than those of the DDT and DDD series. Unlike these, the unsubstituted parent compound was as effective as the difluoro and dichlor derivatives, but in all of them, the dibromo analogue showed low toxicity. Unlike the DDT group, bis(3,4-dimethylphenyl)trichlorpropene was not more effective than the 2,4- and 2,5-isomers ; all three showed a slight activity, whereas the corresponding derivatives in the DDD series were inactive.

Sauberlich (H. E.) & Baumann (C. A.). **Effect of Dietary Variations upon the Toxicity of DDT to Rats or Mice.**—*Proc. Soc. exp. Biol. Med.* **66** no. 3 pp. 642–645, 20 refs. New York, N. Y., 1947.

The following is virtually the authors' summary. Mice that received 0·03–0·04 per cent. DDT incorporated into a medium fat diet (5 per cent.) developed toxic symptoms and died ; 0·1–0·15 per cent. DDT in the same diet was necessary to produce a similar toxicity to rats. A reduction in the level of dietary fat to 0·5 per cent. decreased the toxicity of DDT to both species. When the diet contained 15 per cent. fat, the symptoms of toxicity were aggravated. Several different types of fat were essentially equal in aggravating the toxicity. In diet of low protein content (10 per cent.), the toxicity of DDT was increased somewhat, whereas when the diet was rich in protein (30 per cent.) the effects were variable.

Fletcher (F. C.). **DDT and the Insect Collection.**—*Pests* **15** no. 3 p. 22. Kansas City, Mo., 1947.

Before 1945, certain insect collections were habitually attacked by *Trogoderma versicolor*, Creutz, with occasional small infestations by *Anthrenus verbasci*, L., and *Attagenus piceus*, Ol. A little paradichlorbenzene was placed in each box or drawer when the naphthalene was replenished in the spring, but in spite of these precautions, new infestations appeared in a few months. During the summer of 1945, DDT was applied as a 10 per cent. solution to walls and ceiling to control flies, and the inside of the drying cabinet, the tops and backs of the racks holding the drawers and boxes and the space under the racks were sprayed at the same time. No infestations of Dermestids of any extent were seen during the following winter and spring, and the customary fumigation with paradichlorbenzene was omitted in the spring of 1946. It is thought that the beetles had hitherto been breeding in dust and débris in the space under the racks.

Wellington (W. G.). **The Light Reactions of the Spruce Budworm, *Choristoneura fumiferana* Clemens (Lepidoptera Tortricidae).**—*Canad. Ent.* **80** (1948) pp. 56–82, 3 figs. Guelph, Ont., 1949.

An account is given of laboratory investigations in Ontario on the reactions to light of the form of *Choristoneura fumiferana*, Clem., that attacks *Abies balsamea* and spruce, and the results are discussed with reference to its observed behaviour in the field [*cf. R.A.E.*, A **38** 4]. The following is substantially the author's summary. Larvae of each of the six instars were at first positive to a discrete source of light. Those in the first two instars retained this orientation under all conditions at room temperature, those in the third became indifferent to light when starved, and those in the last three instars first performed light-compass orientations during starvation and then became photonegative ; unless fed or specially treated, they remained so. Photic orientation could be changed by experimental means. It was shown that larvae were photopositive when the digestive tract was naturally or artificially distended or if external pressure was applied to the fifth segment of the body. Compass reactions or photonegative behaviour occurred when the digestive tract began to empty or when the ganglion of the central nervous system in the fifth segment was anaesthetised. All instars were positive to diffuse light at room temperature, even if negative to a discrete source of light. All larvae became negative to both the direction and intensity of light at high temperature. The limits were about 28°C. [82·4°F.] for the first instar, about 36°C. [96·8°F.] for the next two and 37–38°C. [98·6 to 100·4°F.] for the last three. Optomotor responses to moving stripes and small squares contrasting in colour with their background were demonstrated with larvae in the photopositive state. Larvae negative to a source of light were not repelled by diffuse light of intensities higher than that of the source. This suggested a primitive type of image formation. Crawling or flying adult males were consistently positive to light, but became adapted rapidly to any intensity, and became inactive [*cf.* **38** 5]. Crawling females were negative to light, becoming adapted to it and inactive just as did the males. On the other hand, flying females at times performed light-compass orientations.

In a discussion of these results, the author explains the observed behaviour of the older larvae during the current outbreak in northern Ontario in terms of the changes induced in their photic reactions by starvation. In heavy infestations, most buds in the upper and middle parts of the tree are occupied, and if larvae in the later instars retained the rigid photopositive reaction shown in the earlier stages, they would starve when the shoots were defoliated. A sixth-instar larva leaving a defoliated shoot eventually falls to a lower level on the tree, where it remains, since, owing to the onset of starvation, it directs itself by the disk of the sun when this is visible, and its movements are thereby confined to a horizontal plane ; under cloudy conditions, it is directed by diffuse light, which is relatively uniform over the tree. Further starvation causes the larva to react negatively to the disk of the sun and move downwards until the sun is no longer visible. It is positive to diffuse light and therefore remains at the periphery of the tree, where the likelihood of encountering fresh food is good. Larvae in the sixth instar often migrate to the lower levels of the tree or the forest floor and subsequently climb back up the tree owing to their positive reaction to diffuse light, which is coming from above.

Moore (H. W.). **Variations in Fall embryological Development in three Grasshopper Species.**—*Canad. Ent.* **80** (1948) pp. 83–88, 4 refs. Guelph, Ont., 1949.

The following is virtually the author's summary. Methods of storing, clearing and examining embryos of *Melanoplus bivittatus*, Say, *M. mexicanus*

mexicanus, Sauss., and *Camnula pellucida*, Scud., within the eggs were developed in Canada and are described. It is shown that eggs of these species vary considerably in the stage of embryonic development at which they enter the winter. This variation differs from year to year and from district to district. Embryos of *Camnula* appear to enter diapause when they have completed not more than 50 per cent. of their development, just before blastokinesis occurs, but they do not always reach this stage before development is stopped by winter temperatures. Their development is similar to that reported for *Austroicetes cruciata*, Sauss. [*cf. R.A.E.*, A **31** 349, etc.], and diapause-type eggs of *M. differentialis*, Thos., in that diapause occurs at the same early stage. Some embryos of *M. bivittatus* and *M. m. mexicanus* reach a much more advanced stage of development in the autumn than those of *Camnula*, and the amount of development in eggs of these species may range from 0 to 80 per cent. In many cases, embryos at widely different stages occur in a collection of pods. If a diapause occurs in the embryonic development of these species it must occur at the 80 per cent. stage, when the embryo is almost completely developed. No eggs of these species have been found to have developed beyond the 80 per cent. stage in autumn. The embryonic development of *M. bivittatus* and *M. mexicanus* differs from that of *Camnula*, *Austroicetes* and *M. differentialis* in not having an obligatory diapause just before blastokinesis. The stage of development of the embryos within a single pod is quite uniform in the three species studied. Sufficient variation in embryonic development in autumn occurs in different years and in different areas in the three species under study to require varying amounts of heat for its completion. This may affect the date of spring hatching and the length of the hatching period.

WISHART (G.). **The Biology of** *Melanichneumon rubicundus* **(Cress.) (Hymenoptera, Ichneumonidae).**—*Canad. Ent.* **80** (1948) pp. 118–137, 13 figs., 19 refs. Guelph, Ont., 1949.

Melanichneumon (*Amblyteles*) *rubicundus*, Cress., has been recorded in Ontario and Quebec and is widely distributed in the eastern half of the United States, but there are only two host records for it in the literature, one, which is doubtful, from *Neodiprion abietis*, Harr., and the other from *Macronoctua onusta*, Grote [*R.A.E.*, A **19** 317]. It has, however, occasionally been reared from *Pyrausta nubilalis*, Hb., in the eastern United States, and a few adults received in Canada were used to establish a breeding stock in the laboratory with a view to its possible liberation against this moth. It is a pupal parasite, and of the three hosts offered to it, it attacked *Loxostege sticticalis*, L., readily, *P. nubilalis* rather reluctantly, and *N. abietis* not at all. It is thought that it parasitises *P. nubilalis* in the field only when other hosts are not available. Observations on its bionomics with *Loxostege* pupae as hosts are recorded, and descriptions are given of the immature stages and the reproductive organs of the adults of both sexes.

The adults were continuously active and fed readily on raisins, sugar and honey; both sexes were to some extent positively phototropic on emergence, but the females later became almost negative in their response. Pairing, which was essential for the production of female offspring, took place shortly after emergence, and both sexes sometimes paired more than once. The preoviposition period ranged from less than 24 hours to 14 days and was usually about 4 days. Eggs were produced over a period of about six weeks in the laboratory. There was a tendency for them to be placed in the head and thorax of freshly formed pupae of *Loxostege* and in the abdomen of more

mature ones. The pupae were attacked up to eight days after formation, but those of *P. nubilalis* were attacked only when freshly formed. The eggs appeared to be distributed among the host pupae at random, and the ovipositing females seemed unable to recognise hosts that already contained parasites until the latter had reached about the third larval instar. The maximum number of eggs laid by one female was 86. The egg, larval, prepupal and pupal stages lasted 28–36 hours and 5, 3 and 6 days, respectively, at 75°F. Parasitised pupae were distinguished by the medium brown coloration at the point of attack and were capable of movement until the parasite larva reached the third instar. Superparasitism was almost invariable, but only one parasite survived in each host. At first, about 56 per cent. of the adults reared were females, but after several generations, the proportion of males increased. The highest percentage survival among larvae kept in cold storage for a long period (70 per cent. after 99 days) was obtained by placing the parasitised hosts in cold storage when the parasite larvae were in the first instar. The adult parasites survived for 74 days in the laboratory, and for less in cold storage. The data indicate that this parasite does not hibernate in the adult stage, but that first-instar larvae might enter diapause if developing in a host that overwinters in the pupal stage.

Wilkes (A.), Coppel (H. C.) & Mathers (W. G.). **Notes on the Insect Parasites of the Spruce Budworm *Choristoneura fumiferana* (Clem.) in British Columbia.**—*Canad. Ent.* **80** (1948) pp. 138–155, 1 fig., 37 refs. Guelph, Ont., 1949.

The following is virtually the authors' summary. Extensive collections of the spruce budworm, *Choristoneura fumiferana*, Clem., were made in the Lillooet area of British Columbia from 1943 to 1947 for the purpose of securing parasites for transfer to infested areas in eastern Canada. In addition to the parasite species selected for liberation [*cf. R.A.E.*, A **36** 78], many others were reared, which provided the basis for a study of the general parasite complex of *C. fumiferana* in this area. In all, 45 species of primary and secondary parasites and one Clerid predator were reared from the collections. The latter and 18 of the parasites have not previously been reported in the literature as attacking *C. fumiferana*, and 19 of its previously recorded parasites were not taken during the current studies. A list is given of the parasite species recorded in the literature from this host previous to the present work.

Of the 27 species shown to be primary parasites, the majority attack the larvae. *Trichogramma minutum*, Ril., was the only egg parasite reared and it was never very abundant. Overwintering larvae were parasitised only by *Glypta fumiferanae*, Vier., *Apanteles fumiferanae*, Vier., and *Angitia* (*Horogenes*) *cacoeciae*, Vier. Fifteen species attack the larvae during their later stages of development and in most cases remain within the host until after it has pupated. Five species parasitise pupae. The stage of the host attacked by three species is unknown. Only 15 of the total number of species taken appeared to be dominant in the parasite complex and are considered of significant importance as factors of control. Most of the others were either hyperparasitic or of infrequent or casual occurrence in the native parasite fauna of *C. fumiferana* in the Lillooet area. The overall controlling effect of parasites in all stages of the host's development combined was high. In some years, over 40 per cent. of the budworms collected were parasitised. In the older infestations, parasitism appeared to be definitely higher than in the more recent ones.

Paul (L. C.) & Berg (V. L.). **An Outbreak of *Aeropedellus clavatus* (Thomas) (Orthoptera, Acrididae).**—*Canad. Ent.* **80** (1948) pp. 174–175, 2 refs. Guelph, Ont., 1949.

Aeropedellus clavatus, Thos., was observed causing economic damage in Saskatchewan for the first time in 1936, when an outbreak in a west-central district destroyed wheat over an area of 300 acres. Two adjoining fields were affected, and the evidence suggests that the nymphs developed from eggs laid in them. Both had been under wheat in 1933 and were disked in the spring of 1936 before being resown to wheat. The dates of sowing differed, and rain fell after the first field was sown. Damage was more severe in the later-sown crop. This Acridid was sufficiently abundant to be of possible economic importance at a place in Alberta in June 1933 and in south-western Manitoba in June 1934. It is widely distributed throughout the North American Plains in a variety of habitats ; the outbreak in Saskatchewan occurred in one of the driest open prairie areas of the province. The grasshoppers of major economic importance there (*Melanoplus mexicanus mexicanus*, Sauss., *M. packardii*, Scud., *M. bivittatus*, Say, and *Camnula pellucida*, Scud.) all showed a considerable reduction in numbers during 1936, and no conspicuous increase of *A. clavatus* was noted elsewhere. It has since disappeared as a pest.

Snapp (O. I.). **New Insecticides for Plum Curculio Control—Second Report.**—*J. econ. Ent.* **42** no. 1 pp. 7–11, 1 fig., 2 refs. Menasha, Wis., 1949.

Further field-cage and large-scale field tests were carried out in Georgia in 1948 to compare some of the newer insecticides with lead arsenate for the control of *Conotrachelus nenuphar*, Hbst., on peach [*cf. R.A.E.*, A **37** 464]. All spray quantities are given per 100 U.S. gals. A mixture of 4 lb. zinc sulphate and 8 lb. hydrated lime was used as a safener for lead arsenate in each application, and 6 lb. wettable sulphur was used for disease control in all applications two weeks after shuck-off and four weeks before harvest in the orchard experiments and in some of the cage tests.

In three series of tests begun in March and April against overwintered adults and three begun in June and July against those of the first generation, the trees were sprayed, and weevils were caged on branches bearing fruit and foliage as soon as the sprays had dried. Several of the insecticides gave better results against the overwintered weevils than against the others. Parathion was very effective against both ; it gave complete kills within 3–4 days at 2 lb. 25 per cent. wettable powder and within 3–6 days at 1 lb., but was less effective at ½ lb. BHC (benzene hexachloride), chlordan and toxaphene were promising, but often little, if at all, more effective than lead arsenate. When compared on the basis of approximately equal strengths of the γ isomer in the diluted spray, a wettable powder prepared from technical BHC was much more effective than a wettable powder or emulsified solution of BHC having a high γ isomer content or an emulsified solution of technical BHC. HETP (hexaethyl tetraphosphate) and TEPP (tetraethyl pyrophosphate) gave good immediate kills at 1 U.S. pint. In one test, deposits of parathion from a spray of 1 lb. powder retained a little toxicity for three weeks, although much of it had disappeared at the end of two, and in another, they had lost nearly all their toxicity after 3–7 days and those from 2 lb. after 17–22 days.

In large-plot tests, the total numbers of fruits that dropped from 40 trees were 107, 890 and 106 after four applications of 4 lb. 50 per cent. BHC wettable powder (6 per cent. γ isomer), 4 lb. 26·3 per cent. wettable toxaphene powder and 1 lb. 25 per cent. wettable parathion powder, respectively, and 1,379 after

three applications of 2 lb. lead arsenate, and the percentages of dropped fruits infested in April were 6·5, 67·4, 24·5 and 81·1 and the percentages of infested fruits at harvest 3·4, 6, 8·4 and 10·4, respectively. Statistical analysis showed that the numbers of dropped fruits were significantly lower for BHC or parathion than for toxaphene, and for toxaphene than for lead arsenate, but there were no significant differences in the numbers of infested fruits at harvest, except possibly between BHC and lead arsenate. When an adjoining peach orchard was fogged with TEPP from an aeroplane about two weeks before harvest, both foliage and fruit were injured. As the same type of injury was observed in some of the experimental plots, it is possible that the drift from the fog may have interfered to some extent with the results of these experiments.

Tests on single-tree plots gave substantially the same results as those on the large plots, the percentages of fruits infested at harvest being 7·9 for 4 lb. BHC wettable powder (6 per cent. γ isomer), 25·2 for 2 lb. 47·2 per cent. wettable chlordan powder, 21·2 for 4 lb. 26·3 per cent. wettable toxaphene, 29·3 for 1 U.S. pint HETP, 23·9, 34·9 and 27·3 for 0·5, 1 and 2 lb. 25 per cent. wettable parathion powder, 19·8 for 1 U.S. pint TEPP, 19·9 for 2 lb. lead arsenate and 35·1 for no treatment. Chemical analysis showed that the parathion residues on peaches four weeks after spraying were negligible and that applications closer to harvest may be necessary for the best control.

On 15th April, dropped peaches were sprayed on the ground with BHC, chlordan or parathion ; larvae left them between 16th April and 12th May and gave rise to adults between 23rd May and 26th June. The numbers of larvae that emerged from 1½ peck lots of fruits and (in brackets) the percentages that gave rise to adults were 813 (69) from unsprayed fruits, 408 (15) from fruits sprayed with 2 lb. 25 per cent. wettable parathion, 727 (77), 445 (66) and 391 (63) from those sprayed with 4, 8 and 12 lb. BHC (6 per cent. γ isomer), and 1,101 (59) from those sprayed with 4 lb. 47·2 per cent. wettable chlordan.

Whereas 69 per cent. of the larvae put in untreated soil gave rise to adults that emerged from the soil, only 11 per cent. did so in soil treated with 6 lb. 25 per cent. wettable parathion applied at the rate of 1 U.S. gal. per 6 sq. yards, though about 20 per cent. transformed to adults that died at the surface. The length of life of the adults that emerged from the treated soil was little, if at all, affected.

Moderate to heavy foliage injury and defoliation were caused by the sprays of HETP and TEPP, and TEPP injured 1·1 per cent. of the harvested fruits, but the other organic materials used in the large or small plot tests caused no injury to the fruit, foliage, buds or wood ; lead arsenate caused about the usual amount of injury. The flavour of ripe fresh peaches was not affected by applications of 4 lb. 50 per cent. wettable BHC (6 per cent. γ isomer) on 22nd March, 5th and 19th April and 31st May, the last being four weeks before harvest.

LATHROP (F. H.). **Biology of the Plum Curculio in Maine.**—*J. econ. Ent.* **42** no. 1 pp. 12–18, 4 figs., 9 refs. Menasha, Wis., 1949.

Observations made in 1936–43 in apple orchards at Monmouth, Maine, near the north-eastern limit of distribution of *Conotrachelus nenuphar*, Hbst., showed that the winter survival of adults in hibernation cages ranged from 0·4 per cent. in 1940–41 to 30·7 per cent. in 1941–42, with an average of 12·4 per cent. The closest correlation between temperature and survival was found when the monthly mean minimum temperatures during December, January and February were considered, minimum temperatures below the average

during this period being apparently associated with survival below the average. Precipitation, which modified the moisture present and (as snow) the protective cover, had the greatest effect between January and March, and when it was below the average in these months there was lower survival than usual. *C. nenuphar* is usually much less destructive in Maine than further south, probably partly because of the comparatively high winter mortality. The first weevils left hibernation between 17th April and 11th May (41–20 days before petal fall of McIntosh apples) and the last ones between 22nd May and 12th July. Neither rainfall nor air temperature was a consistent or accurate index to emergence, but there was a high correlation between cumulative emergence and the accumulated daily mean temperature and rainfall for a period of about 30 days before any given percentage of emergence. It seems probable that the weevils are sluggish at first and may come out on warm days in early spring and return to protected places when the weather is unfavourable ; this may account for the delay between emergence from hibernation of a large proportion of them and their appearance on the apple trees.

Jarring of neglected apple trees showed that the weevils began to appear in the trees at about the pink blossom stage ; their numbers increased rapidly during late May and early June, after which they remained fairly constant for about three weeks and then declined rapidly until early August. Adults of the new generation began to leave the soil and appear in the trees about the middle of August ; their numbers reached a peak in early September and then declined rapidly. There were considerably fewer summer adults in the trees than overwintered ones, and it was evident that many of them were entering hibernation even while emergence from the soil was in full progress. Observations in 1940–42 showed that oviposition began between 29th May and 10th June (6–12 days after petal fall) and reached a maximum between 25th June and 11th July. There were 62, 69 and 31 eggs per 100 apples at the peak of oviposition in 1940, 1941 and 1942, when the average maximum temperatures for five days before the peak were 86, 90·4 and 75·6°F. However, the beginning of oviposition and the numbers of eggs in the apples from time to time through the season did not appear to depend entirely on temperature ; the rate of growth and the size of the young apples probably affected the former and the numbers of weevils in the trees affected the latter. The length of the larval feeding period varied from about 27 days for the early larvae during June to about 14 days at the peak of larval occurrence, during July. Larvae began to leave the fallen apples between 30th June and 13th July (34–41 days after petal fall) and the average numbers doing so increased rapidly until the last half of July, and then declined until between 16th August and 11th September, when the last larvae left the apples. The larvae left the apples during the period when the highest average temperatures usually occur, and no very evident effect of temperature on emergence was noted, but rainfall during the period was frequently followed by increased emergence. Daily observations during 1937 and 1939–42 showed that emergence of the adults from the soil began between 20th July and 21st August (67–83 days after petal fall), the peak, when 50 per cent. had emerged, occurring between 22nd August and 8th September. The adults fed on apples for some time before going into hibernation and caused considerable minor injury to the fruit. There was no evidence of oviposition in the autumn, and no larvae or pupae survived the winter in the soil and transformed to adults in spring.

Bobb (M. L.). **Hibernation of the Plum Curculio in Virginia.**—*J. econ. Ent.* **42** no. 1 pp. 19–22, 8 refs. Menasha, Wis., 1949.

It was observed in Virginia during the winter of 1936–37 that burning the débris in woodland near peach orchards in the winter (January and February)

killed few if any hibernating adults of the plum curculio [*Conotrachelus nenuphar*, Hbst.], whereas in later years burning it in spring (late March), when the peach buds were in the pink-tip stage, caused a 75 per cent. decrease in population in the orchard. However, such burning is considered of doubtful value, since it does not permit any reduction in the number of sprays that must be applied, though it may be useful as a supplementary measure in case of very heavy infestation. Examination during the winter of hibernation cages in which adults had been liberated in the autumn of 1937 revealed no weevils under the dead grass on the ground, but in spring slightly more than 50 per cent. of the beetles emerged. Similar experiments in 1946–47 and 1947–48 showed that the weevils hibernated in the soil. They spent the winter at an average depth of about 2·5 inches in moist red clay soil and about 1·6 inches in hard rocky soil and more than six inches deep in loose soil and sand. In 1947–48, the winter mortality in the clay soil (46·67 per cent.) was significantly greater than that in sandy soil (21·33 per cent.), and the weevils emerged earlier from sandy than from clay soil, which was generally cooler by 2–5°F. during March and April. The weevils began to emerge when the mean soil temperature at a depth of three inches was about 50°F. and went back into shelter if cold weather occurred soon after they had emerged. Observations over a period of years indicated that some weevils seek hibernation quarters early in autumn. They apparently remain in and under the surface cover at first, but burrow into the ground as winter approaches. In the spring they move up to the ground surface when the soil temperature is nearly 50°F., and may remain with only the rostrum projecting for several days, until the temperature rises and they emerge and enter the orchards. Spring rains stimulate large numbers of weevils to activity by warming the ground and making it easier to penetrate.

Summers (F. M.). **Resistance to Basic Lead Arsenate by the Peach Twig Borer within a small Area in central California.**—*J. econ. Ent.* **42** no. 1 pp. 22–24, 13 refs. Menasha, Wis., 1949.

During 1944, populations of *Anarsia lineatella*, Zell., began to increase in a small area near Empire, Stanislaus County, California. Before this time, two applications of sprays of basic lead arsenate had given satisfactory control, but in 1945–47, serious losses, averaging about 20 per cent., were sustained in the late varieties of cling peaches. Additional lead-arsenate sprays or dusts provided some relief, but no combination of them, ranging up to five applications, was wholly effective. This suggested that the local larvae had acquired some resistance to the insecticide, and experiments were therefore carried out in which they were compared with larvae of the same generation from young almond orchards at Arbuckle, California, that had never received arsenical sprays. Peaches were dipped in suspensions of 1, 2 and 4 lb. basic lead arsenate (96 per cent. active ingredient) per 100 U.S. gals. water containing 0·1 per cent. spreader, allowed to dry and infested with eggs of *Anarsia* deposited on leaves by adults from larvae of the May brood. Two days after the hatching date, the numbers of eggs and successfully established larvae were counted. Only about 50 per cent. of the larvae established themselves in untreated fruits and there were no differences between larvae from the two localities on these. A considerably higher proportion of larvae from Empire than from Arbuckle became established in treated fruits, indicating that fewer of the former were susceptible to lead arsenate, and the differences were highly significant in three tests, significant in one and doubtfully significant in one. Mortality did not increase with the concentration of lead arsenate, probably owing to the method of application. These results tend to confirm the assumption that the resistance of *A. lineatella* to basic lead arsenate has increased in the district round Empire.

Hamilton (D. W.). **Oriental Fruit Moth Control with DDT.**—*J. econ. Ent.* **42** no. 1 pp. 25–28, 5 refs. Menasha, Wis., 1949.

In New York, properly applied late-season schedules of DDT have seemed to be more dependable in preventing injury to peach by *Cydia* (*Grapholitha*) *molesta*, Busck, than the parasites formerly liberated against it [*cf. R.A.E.*, A **36** 56], but the control obtained has not always been as good as desired, and DDT residues on harvested fruit have sometimes been high, especially when more than two applications were made or when DDT was applied just before harvest. In 1948, therefore, the author investigated the possibility of controlling *C. molesta* with DDT applied early in the season and the effect of such applications on other peach pests.

The early sprays were applied in an isolated test orchard, since the moths are strong fliers, on 11th May (petal-fall), when most moths of the spring generation were present, and on 20th and 28th May and 8th June, the last three being timed principally for the control of *Conotrachelus nenuphar*, Hbst. They were preceded by a prebloom sulphur spray and followed by a spray containing sulphur paste and a salt of dinitro-o-cyclohexylphenol applied on 11th August against mites. DDT was used at 2 lb. 50 per cent. wettable powder per 100 U.S. gals. with 5 lb. micronised wettable sulphur in all four sprays, with the addition of 3 lb. BHC powder (50 per cent. total benzene hexachloride and 6 per cent. γ isomer) in all but the first, and 0·5 lb. polyethylene polysulphide adhesive [*cf.* **37** 308, etc.] in the second. Moth captures and twig and fruit injury were compared with those from a control orchard that received DDT sprays on 1st and 14th July against the second generation and 5 per cent. DDT dust on 4th August against the third. More than 37 per cent. of the total number of moths caught during the season were taken before 11th May in the test orchard, as compared with less than 17 per cent. in the control orchard. Daily moth captures decreased immediately after the first DDT application in the test orchard, and the total catches of moths in the two orchards were 31 and 2,067 between 25th June and 25th July, 151 and 836 between 26th July and 22nd August and 86 and 794 between 23rd August and 29th September. Larvae began to enter twigs on 20th May, and twig injury was severe in most orchards in the district, but no infested twigs were found in the test orchard until 23rd June, and the seasonal average of infestation on five trees was 7·4 twigs per tree; no injured peaches were observed on these trees. Less than 1 per cent. of the fruit was injured at harvest in the test orchard, as compared with 8·9 per cent. in the control orchard and 2·7 per cent. in another orchard that received two sprays of 2 lb. and one of 1 lb. 50 per cent. DDT per 100 U.S. gals. in July–August. Control of *C. nenuphar* was excellent, owing to the inclusion of BHC, and no catfaced peaches, caused by sucking insects early in the spring, could be found. The percentage of peaches injured by *Eulia* (*Argyrotaenia*) *velutinana*, Wlk., was only 0·26, and injury by *Popillia japonica*, Newm., and *Aegeria* (*Sanninoidea*) *exitiosa*, Say, was not of commercial importance. Since the last two insects do not emerge until early July, it is unlikely that the early schedule would control them. *Tetranychus bimaculatus*, Harvey, and *Paratetranychus pilosus*, C. & F., were both present and seemed to increase earlier in the season than in orchards in which DDT was not applied before 1st July, but the dinitro spray reduced their numbers to a low level for the rest of the season. Control of brown rot [*Sclerotinia*] was better than that generally secured, possibly because of the absence of insect lesions. No observations were made on the effect of either DDT or BHC on parasites and predators of *Cydia*; natural parasitism is very low in this district. Spray injury to the foliage, attributed to the polyethylene polysulphide, was evident after the second application, and leaf-drop occurred in some instances; the sulphur-dinitro spray applied in August also injured the leaves.

The advantages of a heavy early-season DDT schedule against *C. molesta* are that the treatments can be combined with those used against other pests, so that the only additional cost is that of the DDT ; that control of other insects and of brown rot may be improved ; that additional sprays can be applied later if necessary ; that the trees can be covered more easily ; and that the residues of DDT on the harvested fruit are light. The principal disadvantages are that mites may increase earlier in the season, so that special sprays will be needed for their control ; that the applications are too early to be effective against *Popillia japonica* and *A. exitiosa* ; and that since there are four generations of *C. molesta* each season, treatments applied in late May and early June must be very thorough to prevent increase to serious proportions late in the season. In orchards that may become reinfested by migration from other orchards, careful watch must be maintained for late-season injury. The results reported are for one season only, and further investigations are desirable before final conclusions are drawn.

Glass (E. H.) & Chapman (P. J.). **Red-banded Leaf Roller Problem in New York.**—*J. econ. Ent.* **42** no. 1 pp. 29–35, 4 refs. Menasha, Wis., 1949.

During 1948, the red-banded leaf roller [*Eulia velutinana*, Wlk.] continued to be a serious problem in many apple orchards in New York [*cf. R.A.E.*, A **37** 381], and became injurious in areas not previously infested. Injury was common in parts of the Lake Ontario fruit district and somewhat less so in the Hudson Valley, and surveys made during harvest indicated that the outbreaks were not entirely confined to orchards in which DDT was used, although there was a tendency for infestations to begin in the year following its first use. The lead-arsenate schedule that formerly gave satisfactory control of the first generation proved inadequate. The first-generation larvae, which had caused little injury in former years, damaged 40–50 per cent. of the fruits on unsprayed trees and caused commercial damage in many well-sprayed orchards. They fed on the leaves until the middle of June, and many then moved to the fruits ; the injured areas on these corked over, and many apples became somewhat deformed. The larvae of the second generation fed on the undersides of the leaves for more than a month and then, in early September, moved to the fruit or the upper surfaces of other leaves ; in orchards in which the second generation was abundant, 50–75 per cent. of the fruits dropped prematurely, and many of those remaining on the trees were injured. The seasonal development of the insect is described ; there were only two generations in western New York, but a partial third developed in the lower Hudson Valley.

In experiments on control, pink, calyx, 10-day and first cover sprays were thoroughly applied against the first generation on the 3rd and 28th May and 9th and 21st June in an orchard in which damage had been severe in 1947. All spray quantities are given per 100 U.S. gals. Calyx and 10-day sprays of 4·8 or 9·6 oz. 25 per cent. parathion gave about 99 per cent. control of fruit injury, and four applications of 2 or 4 lb. 50 per cent. DDT or four of lead arsenate (3 lb. in the first and last and 6 lb. in the others) gave more than 90 per cent. It seemed likely that DDT in the calyx and 10-day sprays was very effective against the newly-hatched larvae as they crawled from the trunks and larger branches to the leaves. Applications of 1 and 2 U.S. gals. petroleum oil at the pink stage gave 74·8 and 88·6 per cent. control. Four of 3 lb. lead arsenate gave about 75 per cent. control, and omitting the first, first two and first three of these reduced the control progressively to zero. Sprays of 2 lb. lead arsenate with 1 lb. 50 per cent. DDT on the last three dates were about as effective as three of 3 lb. lead arsenate. It was evident that lead arsenate gave some control of the first generation when applied in the pink, calyx and 10-day

sprays, but not in the first cover spray. The use of oil in the pink spray is questionable, because of possible injury due to the combination with sulphur. Several applications of sulphur were made to the sprayed trees, and there was considerable drop of small primary leaves after the application of 1 per cent. oil, but no commercial injury. The oil sprays caused more than 95 per cent. reduction in hatching, as calculated by Abbott's formula [**13** 331], and if most of the eggs are deposited before the pink spray each year, a 1 per cent. oil spray would be valuable when oviposition was heavy.

In an orchard in which lead arsenate had been used against the first generation with poor results, various insecticides were applied on 28th July and 9th August against the second, and the numbers of feeding areas per 100 fruits were counted at harvest. Sprays containing 3 lb. 50 per cent. methoxy-DDT (methoxychlor), 2 lb. 50 per cent. chlordan or 1 U.S. pint of a material containing 25 per cent. tetraethyl pyrophosphate and 30 per cent. other related phosphates gave only small reductions, and 3 lb. 25 per cent. chlorinated camphene [toxaphene], though giving considerable control, did not affect other insects present and was not considered further ; 3 lb. 50 per cent. DDT gave over 80 per cent. control when applied twice from the inside and outside of the tree, but was less effective when applied on the first date or from the outside of the tree only. One application of 0·5 lb. 25 per cent. parathion on the second date gave 86 per cent. control and two gave 91 per cent., when applied from the outside only and 93 per cent. from both inside and outside. Two sprays of 3 lb. lead arsenate gave 99·1 per cent. control, and two of 3 lb. 50 per cent. DDD (dichlordiphenyldichlorethane) gave 99·9 per cent. None of the treatments injured the fruit, but lead arsenate caused appreciable foliage injury.

In another orchard that had received lead arsenate against the first generation, second-generation sprays were applied on 29th July and 10th and 20th August and feeding injuries recorded at harvest. Applications of 2 or 4 lb. 50 per cent. DDD on the first two dates gave 99–100 per cent. control, three applications of 3 lb. lead arsenate gave 99 per cent., and one or two of 1 lb. 25 per cent. parathion on various dates gave 94–96 per cent. ; exact timing was evidently not necessary with this compound. Two applications of 4 lb. 50 per cent. DDT gave 90 per cent. control, but two of 2 or 3 lb. were less effective ; applications on 10th and 20th August were less effective than those on 29th July and 10th August, and a third application at 3 lb. gave little increase in control. Sprays of 1 U.S. gal. petroleum oil on the first two dates gave 85 per cent. control, but would not be commercially satisfactory against a serious infestation.

The results indicate that the addition to a programme of DDT sprays against the codling moth [*Cydia pomonella*, L.] of one or more sprays of DDD or parathion against *Eulia* will be desirable.

MIDDLEKAUFF (W. W.). **The Omnivorous Leaf Tier in California.**—*J. econ. Ent.* **42** no. 1 pp. 35–36, 3 figs., 2 refs. Menasha, Wis., 1949.

In late April 1948, considerable feeding on flax by larvae of *Cnephasia longana*, Haw. [*cf. R.A.E.*, A **23** 135] was observed in fields near Palo Alto, Santa Clara County, California, and a light infestation was found in one field in San Mateo County, where much flax is grown and where similar injury had occurred since 1942. The larvae were also collected in the latter district from *Gladiolus* in 1947 and from other ornamental plants in 1948, and their presence on them in the centre of an extensive area devoted to floriculture is considered very disturbing, as no control measure is known.

On 20th April 1948, about 30 per cent. of the flax plants in Palo Alto were infested. The flax was just coming into bloom and many of the larvae were in the fourth and fifth instars. The larvae webbed the tender terminal leaves

together and fed on them. The webbed leaves ceased to grow, and the plant produced lateral shoots below the injury ; these flowered and produced seed, and it was considered that a light infestation would not materially reduce the yield, since flax is grown only for seed in California, though the flowers and young pods were attacked to some extent. On 26th April, many of the larvae had left the plants to pupate, but no pupae were collected by examining plants or soil samples or by sweeping in this or subsequent surveys. Larvae collected on 20th April began to pupate on 24th April and gave rise to adults from 3rd May. No parasites were recovered from the larvae taken to the laboratory.

ROSENSTIEL (R. G.). **Life History and Control of the Orange Tortrix in Oregon.**—*J. econ. Ent.* **42** no. 1 pp. 37–40, 9 refs. Menasha, Wis., 1949.

Tortrix (*Argyrotaenia*) *citrana*, Fern., became injurious to raspberry, Boysenberry and blackberry in the northern Willamette Valley of Oregon in 1947 and continued so in 1948 [*cf. R.A.E.*, A **38** 25]. Larvae of different sizes overwintered under dead leaves caught on the plants, in cane galls or (on raspberry) in small cavities just below the buds, and fed on the outer surface of the canes on the warmer days, but did not cause serious injury. They left their shelters to feed on the developing leaves and buds in March. The generations overlapped, so that all stages were present in the field during summer. The pupae were usually found in the webbed leaves, but sometimes occurred in the fruits or among dead leaves on the ground. The adults flew on warm summer evenings when the air was still. Numerous baits tested were ineffective, and light-traps were only moderately attractive.

In tests on blackberry in 1947, dusts containing 5 per cent. DDD (dichlordiphenyldichlorethane) or 40 per cent. cryolite, applied on 30th July, or a 5 per cent. DDD dust or a spray of 8 lb. 5 per cent. DDD per 100 U.S. gals. with a wetting agent, applied on 7th August, gave very effective control, whereas DDT dusts and sprays, dusts of rotenone or chlordan and an oil emulsion spray were relatively ineffective. In 1948, dusts containing 2–5 per cent. DDD gave more than 90 per cent. control, dusts containing 5 per cent. ditolyl trichlorethane [methyl-DDT] or 10 per cent. chlorinated camphene [toxaphene] gave more than 70 per cent., and 70 per cent. cryolite and 5 per cent. chlordan each gave less than 50 per cent. Sprays of 2 lb. 50 per cent. DDD alone or with 2–4 U.S. quarts oil per 100 U.S. gals. gave more than 90 per cent. control, and a spray of 4 pints 44 per cent. chlordan per 100 gals. gave 86·1 per cent. when used alone and 91·4 per cent. when 4 quarts oil was added. Sprays of rotenone, cryolite or parathion were less effective whether applied alone or with oil.

It is concluded that DDD is very effective against *T. citrana* and that DDT is not [*cf. loc. cit.*]. Of the parasites reared from it, *Apanteles aristoteliae*, Vier., was common and *Itoplectis obesus*, Cushm., and *Angitia* (*Horogenes*) *eureka*, Ashm., also gave important control.

NEISWANDER (R. B.). **The Grape Mealybug on *Taxus* in Ohio.**—*J. econ. Ent.* **42** no. 1 pp. 41–44, 1 fig., 4 refs. Menasha, Wis., 1949.

Pseudococcus maritimus, Ehrh., was first found on yews (*Taxus*) in Ohio in 1938 and has become troublesome on them since 1943. It causes most concern in nurseries, but also injures ornamental plantings. No species of *Taxus* has been observed to escape attack, but the most severe infestations have occurred on the more dense and compact types. Observations made since 1944, mainly on three heavily infested plants of *T. brevifolia* that were moved from nurseries in northern Ohio to Wooster, showed that the mealybugs

overwinter in the first instar within a mass of white waxy threads produced by the female and further protected by débris webbed together, usually in the interior of the plant near the main stem. They move to the twigs to feed in April or May and reach the adult stage and oviposit during the second half of June. Newly hatched crawlers of the summer generation were observed as early as 28th June, but hatching continued throughout the first half of July. They soon left the cottony protection and began to feed on the twigs, and some reached the adult stage during August and deposited eggs of the overwintering generation by the end of the month. Oviposition continued until late autumn, and hatching from about 15th September until the onset of cold weather. Eggs were found on the main stems of the plants just below the surface of the soil in December 1944, but did not survive the winter. No viable eggs were found in spring. The eggs were frequently attacked by natural enemies, and the predacious Hemerobiid, *Sympherobius amiculus*, Fitch, and an unidentified Encyrtid of the genus *Pseudleptomastix* were reared in significant numbers from egg masses collected in nurseries in northern Ohio. The three infested plants moved to Wooster received no insecticidal treatment, but the infestation had disappeared by 1947 owing to attacks by natural enemies.

Experiments with various insecticides in 1944–48 showed that treatment was more effective in late May and early June and again in August, when the mealybugs were feeding on the twigs, than in April, when they were well protected in their hibernation sites, or in late June and July, when many were in the egg stage deeply embedded in the cottony masses. The best results (effective control by two applications in late May and early June) were given by sprays of parathion (1 lb. 25 per cent. powder per 100 U.S. gals.) and a proprietary thiocyanate preparation ; oil emulsions were unsatisfactory in some tests, but effective in others, in which, however, they injured the foliage.

Chapman (P. J.) & Pearce (G. W.). **Susceptibility of Winter Eggs of the European Red Mite to Petroleum Oils and Dinitro Compounds.**—*J. econ. Ent.* **42** no. 1 pp. 44–47, 1 graph, 2 refs. Menasha, Wis., 1949.

Experiments on the effect on winter eggs of the European red mite [*Paratetranychus pilosus*, C. & F.] of dinitro compounds used alone and in combination with oil and the efficiency of oil sprays applied at various intervals before hatching were carried out in apple and peach orchards in New York in 1948. The results were based on the rate of hatching of the eggs in samples of spurs or twig sections taken at random from sprayed and unsprayed plots, and the records obtained on apple and peach were combined. An oil with a viscosity of 103·9 secs. Saybolt at 100°F. and an unsulphonated residue of 92 per cent., which met the requirements for a superior-type spray oil for use at the dormant and semi-dormant stages, was used throughout, with blood albumin as the emulsifying agent. The two dinitro products tested were a slurry containing 22 per cent. sodium dinitro-o-cresylate (Elgetol) and a liquid formulation containing 36 per cent. of the triethanolamine salt of dinitro-o-sec.-butylphenol (DN 289). The oil sprays were applied at the beginning of the hatching period (on 26th April) and 6, 16, 21 and 39 days earlier, and the susceptibility of the eggs increased as the interval between spraying and hatching was reduced, 0·25 per cent. oil applied when hatching began being as effective as 3 per cent. applied 39 days before, in the dormant period (about 90 per cent. control efficiency). At least 97 per cent. mortality is required for effective control, and this was given by 2 per cent. oil 16 and 6 days before hatching (green-tip and delayed-dormant stages on apple) and by 0·5 per cent. at hatching time. The dinitro compounds were applied on 24th March to apple in the dormant stage ; 0·5 per cent. Elgetol with 1 per cent. oil

proved ineffective, but 0·25 and 0·5 per cent. DN 289 gave 68·3 and 97·2 per cent. control and 0·25 per cent. with 0·25, 0·5 and 1 per cent. oil gave 86·9–92·9 per cent. Since this compound is also effective against Aphid eggs and hibernating larvae of the eye-spotted bud moth [*Spilonota ocellana*, Schiff.] it should be considered as a general dormant treatment for apples in New York. It is highly caustic and should be used only in the true dormant stage until it has been tested further.

Barnes (D. F.) & Stafford (E. M.). **Control of the Fig Scale in California.**—*J. econ. Ent.* **42** no. 1 pp. 48–55, 1 fig., 3 refs. Menasha, Wis., 1949.

Lepidosaphes ficus, Sign., which was introduced into California about 1905, had become widespread on fig by 1943, and since many of the infestations were heavy, investigations on its bionomics and control were carried out, chiefly in 1944–46. The authors confirm Lupo's conclusion that *L. ficifoliae*, Berl., is merely the summer form of the Coccid [*R.A.E.*, A **35** 284]. The adult females mate in late autumn and overwinter on the trees, usually on wood 1–2 years old. Oviposition sometimes begins in February, but does not become general until the middle of March, and the overwintered females lay about 30 eggs each. Hatching begins in early April and continues well into June ; most of the crawlers of this and subsequent summer broods settle on the leaves, but some settle on the fruits and it is these that are the most injurious. The first-generation females lay about 12 eggs each, and those from the earliest hatch in mid-June. The males are found almost exclusively on the leaves, but after midsummer, many of the female crawlers establish themselves on the wood, the numbers doing so increasing rapidly during August.

Experiments on control were carried out on drying and canning figs, chiefly by means of dormant sprays. Dormant trees of the drying variety (Adriatic) required 13–15 U.S. gals. spray, and those of the canning variety (Kadota) 3–6 U.S. gals. Control was estimated by the mortality of the overwintering scales, the number of scales of the first generation established on the foliage in the middle of June and the percentage of fruits infested at harvest. Sprays of 2 per cent. dormant oil did not give satisfactory control, but 3 per cent. dormant oil, alone and with 3 per cent. lime-sulphur, and 4 per cent. dormant oil were all effective, the control increasing in the order named. The susceptibility of the Coccids varied little between December and early March ; when spraying was delayed until the females had begun to oviposit, some of the eggs hatched, but few of the young lived after crawling on the oiled bark. The addition of ovicides (preparations of sodium dinitro-o-cresylate with or without a wetting agent) to the dormant oils during the oviposition period did not increase the mortality of overwintered scales, and although fewer eggs hatched, the numbers of first-generation crawlers that settled on the leaves were not reduced, owing to the mortality of crawlers afforded by the deposit of oil alone. Sprays of summer oil, alone or with additions, were tested on canning figs in May, when the first-generation crawlers were settling and before any of the summer scales were mature. Most of the scales were on the leaves, and it was more difficult to cover all of them with oil than in the winter. Sprays of 2 per cent. light or light-medium oil gave good control and were as effective as 4 per cent. dormant oil applied in February, but injured the foliage in some cases. The addition of cubé did not improve control. A spray of 3 per cent. of concentrate containing 8 per cent. DDT and 20 per cent. Velsicol AR60 (methylated naphthalenes) in kerosene gave even better control but caused severe defoliation.

Parathion gave promising results in a preliminary test in 1947 ; a single tree was sprayed with a 20 per cent. solution in di-2-ethylhexyl phthalate at a

dilution of 1 : 800. The spray was applied on 31st March when the hatching of eggs of the overwintered females was about to begin, and the tree was examined early in July, when adults were numerous on other trees. Only immature scales were found on it, indicating that the crawlers of the earlier part of the hatching period had been killed and that some of those that hatched later had survived.

Rodriquez (J. G.) & Neiswander (R. B.). **The Effect of Soil Soluble Salts and Cultural Practices on Mite Populations on Hothouse Tomatoes.**—*J. econ. Ent.* **42** no. 1 pp. 56–59, 2 figs., 5 refs. Menasha, Wis., 1949.

The following is based on the authors' introduction and summary. *Tetranychus bimaculatus*, Harvey, is of great economic importance on vegetables grown in greenhouses in Ohio, especially tomatos. Once the mites have appeared on a crop, they spread rapidly if not checked, and the control measures are expensive. To prevent infestations remaining in the greenhouse from a previous crop, the growers usually sterilise the soil with steam and fumigate the greenhouse with sulphur or azobenzene, but in spite of precautions, some greenhouses observed over a period of years seemed to have a regular recurrence of mite infestations, whereas others were seldom if ever infested. Possible relationships between soil or cultural factors and the occurrence of *T. bimaculatus* on tomato were investigated in 1946–48. It was found that the type of cropping system employed was a determining factor for mite occurrence or degree of infestation, more than ten times as many mites being found in greenhouses where two tomato crops were grown each year than in those in which an annual tomato crop was alternated with radishes, cress or lettuce. A significant positive correlation was found between the specific conductivity, or soluble salt content, of the soil and the mite population during the first year, but not in the next two. Both the specific conductivity of greenhouse soils and the mite population showed a decrease over the three years, however, apparently owing to a decrease in the use of fertiliser. The soluble salt content of soils is an index of ionic concentrations and suggests approaches to certain entomological problems involving inter-relationships between soils, plants and plant-feeding forms.

Type of mulch had no apparent relation to mite occurrence. A straw mulch apparently did not discourage mite introductions, and a clover mulch did not encourage them ; inconclusive results were obtained with three other less popular types.

Dominick (C. B.). **Aphids on Flue-cured Tobacco.**—*J. econ. Ent.* **42** no. 1 pp. 59–62, 1 fig. Menasha, Wis., 1949.

Patches of heavy infestation by Aphids were observed in three fields of flue-cured tobacco in Pittsylvania County, Virginia, in late July 1946, and in 1947 the insects were more numerous and caused slight to moderate damage to some tobacco. *Myzus persicae*, Sulz., was probably the commonest species involved. The Aphids were distributed irregularly, showing a marked preference for shaded areas, and persisted on tobacco suckers after harvest until the plants were killed by frost. In 1948, infestations were heavy on tobacco plants in several plant beds and on some of the newly set tobacco, and damage during the growing season was considerable where adequate control measures were not applied. The value of heavily infested mature tobacco was reduced by premature yellowing of the leaves, the growth of sooty mould on honeydew deposits, and contamination by the cast skins of the Aphids. Predators were present in most infested fields and controlled light infestations. *Hippodamia convergens*, Guér., was the commonest, and *Adalia bipunctata*, L., and other

Coccinellids were present in some fields. Syrphid larvae, chiefly those of *Sphaerophoria cylindrica*, Say, occurred on most infested plants, and larvae and adults of *Chrysopa* spp. were also found.

In preliminary tests in 1947, nicotine as a 3 per cent. dust or a spray (1 : 400) was ineffective, but a dust of 1 per cent. parathion and a spray of 1 lb. 15 per cent. wettable parathion powder per 100 U.S. gals. water gave complete control ; hexaethyl tetraphosphate applied as a spray had a similar effect. In 1948, the parathion dust and spray applied at 1 lb. and 6 U.S. gals., respectively, per 100 sq. yards to plant beds when the plants were 8 ins. high gave 100 and 99·5 per cent. reduction in numbers of Aphids and protected the plants for several days. In field tests in which sprays and dusts were applied at 65 U.S. gals. and 17 lb. per acre, respectively, on 21st June, when the plants were about 42 ins. high, 1 and 0·5 per cent. parathion dust gave 100 and 98·5 per cent. reduction and sprays of 1 lb. 15 per cent. wettable parathion, 2 U.S. pints 10 per cent. tetraethyl pyrophosphate, and 2 U.S. pints nicotine sulphate with soap per 100 U.S. gals. water 98·7, 99·2 and 12·2 per cent., respectively. When applied to plants 15 ins. high on 30th June, dusts of 0·5 and 1 per cent. parathion and 1·5 per cent. γ BHC (benzene hexachloride) at 10 lb. per acre gave 98·2. 100 and 94·1 per cent. reduction, and sprays of 2 U.S. pints 10 per cent, tetraethyl pyrophosphate and 2 lb. 25 per cent. γ BHC per 100 U.S. gals. water applied at 40 U.S. gals. per acre gave 99·3 and 99·4 per cent. When applied at 15 lb. per acre to plants 30 ins. high on 21st July, 0·5 and 1 per cent. parathion dusts gave 98·8 and 99·9 per cent. reduction. None of the materials tested injured the plants or affected the curing process.

In a test of the durability of parathion deposits, plants were dusted with 1 per cent. parathion and Aphids were confined on leaves taken from them 1–11 days later. All the Aphids were dead in 24 hours on leaves taken after 1 and 3 days, and 98, 92, 41 and 4 per cent. were dead after 48 hours on those taken after 5, 7, 9 and 11 days, the percentages dead on untreated leaves being 4, 4, 3 and 3, respectively, indicating that the dust remained highly effective for at least a week.

WOODSIDE (A. M.). **The Tobacco Stalk Borer in western Mexico.**—*J. econ. Ent.* **42** no. 1 pp. 63–67, 4 refs. Menasha, Wis., 1949.

Trichobaris mucorea, Lec., causes serious losses of tobacco in the State of Nayarit, the most important tobacco-producing region of Mexico, and investigations on its bionomics and control were carried out between November 1947 and March 1948. Adult weevils were present on the larger plants in the plant beds when the work was begun, and soon became more numerous. They were more active when the temperature was high and preferred the larger plants, so that populations dropped sharply when plants were taken from a bed for transplanting. Irrigation of the plant beds was discontinued about mid-January, and this was followed by a big reduction in the population, though numbers in the tobacco fields were increasing rapidly at this time. The weevils were inactive below 60°F., and were rarely found on the plants at such temperatures. As the temperature rose their activity increased, and they crawled on the tops of the leaves at 70°F. if the air was still, and began to fly at temperatures above 80°F. Activity was reduced in windy or cloudy weather, and males were more active than females. The latter were most common on the stems or petioles, where they chiefly fed and oviposited. The eggs were deposited singly in any part of the plant in which the female could make a suitable cavity, but chiefly in the stems. The larvae fed in the cavities for 24 hours or longer and then tunnelled through the tissues of the plant in any direction. Pupation occurred in cells near the surface, and the adults did not usually leave

the cells for several days after emerging. In the insectary, 17 females from the plant beds laid 17–128 eggs over periods of 15–98 days, eggs deposited between 26th November and 12th February hatched in 7–17 days, and the combined length of the larval and pupal stages varied from 39 to 56 days. There may be six overlapping generations in the year.

The larvae were numerous in the stems of *Physalis angulata* in November and early December, but the adults were seldom found on it and evidently preferred tobacco for oviposition as soon as the plants were large enough. The larvae developed normally in *P. angulata* and matured about as quickly as in tobacco, and this common weed may be important in maintaining a fairly high level of infestation when tobacco is not generally available. Larvae believed to be those of *T. mucorea* were found on several occasions in the petioles of *Solanum diversifolium*, which is common but rather too woody to provide much food ; it may be an important food-plant in the rainy season. No larvae were found in *Datura*, and wild or self-sown tobacco was usually less heavily infested than the tobacco plants in the fields. No parasitised larvae were found in tobacco, but a few occurred in stems of *P. angulata*. This plant was also injured by the larvae of *Langurites* sp., and these Erotylids, which were common, destroyed the larvae of *T. mucorea* whenever they encountered them.

About 29 per cent. of the plants taken from the beds were infested, 22 per cent. by larvae and 10 per cent. by eggs. When tobacco is transplanted, the plant makes no growth for 7–10 days or longer ; the part above ground dies, and after several days a shoot grows from a bud beneath the surface to form the main stem. Plants that contain larvae when transplanted are likely to be killed during this period, but those in which the eggs hatch after they are set in the field usually survive, though the feeding of the larvae often weakens or kills the first bud that develops, resulting in the production of several small stems or suckers instead of a central stem. Such plants produce a relatively small quantity of inferior tobacco, and this type of injury is responsible for the greater part of the losses caused by the borer. It occurred in 50 per cent. or more of the plants in some fields. Larvae that hatch from eggs deposited after transplanting do not cause severe injury unless several are present in one plant.

Counts of eggs on field plants that received six applications of a spray of 4 lb. 25 per cent. wettable DDT powder per 100 U.S. gals. or a 10 per cent. DDT dust between 22nd December and 16th January or six of the DDT dust between these dates followed by two of 5 per cent. chlordan or the DDT dust on 23rd and 30th January showed that all the treatments considerably reduced oviposition and that the DDT spray and the chlordan dust retained their effectiveness for longer than the DDT dust. When applied to a plant bed on 29th January and 4th and 11th February, the DDT spray and sprays of 2 lb. 50 per cent. chlordan, 3 lb. BHC powder (50 per cent. total benzene hexachloride and 6 per cent. γ isomer) and 2 lb. 50 per cent. chlorinated camphene [toxaphene] per 100 U.S. gals. reduced the numbers of eggs per 100 plants on 19th February from 80 for no treatment to 18, 10, 0 and 25, respectively. Dead borers were found in plants that had been sprayed with BHC. BHC gave the quickest kill of adults that were caged with freshly sprayed foliage, DDT and chlordan were somewhat slower, and toxaphene was the slowest in paralysing and killing them.

Douglass (J. R.) & Shirck (F. H.). **Experiments for Control of Onion Thrips.**—*J. econ. Ent.* **42** no. 1 pp. 68–72, 5 figs., 12 refs. Menasha, Wis., 1949.

Thrips tabaci, Lind., is the major limiting factor in the production of onions in Idaho, though its attacks are sporadic. In 1945, laboratory experiments showed that DDT was slow in killing the thrips and that nicotine sulphate

was faster but had a less persistent effect, and in 1946 and 1947 mixtures of DDT and nicotine sulphate were compared with other insecticides in spray tests in the field. Onions of a susceptible variety were grown in rather dry soil of low fertility, in order to induce thrips injury, and the sprays were applied five times at weekly intervals in 1946 and three times at intervals of ten days in 1947. All spray quantities are given per 100 U.S. gals.; the BHC (benzene hexachloride) used in 1946 contained 10 per cent. γ isomer and that used in 1947 contained 12 per cent. In the first year, 1 lb. DDT in a wettable powder with 1 U.S. quart nicotine sulphate and a wetter and spreader gave a higher yield than 5 lb. BHC in a wettable powder and significantly higher yields than 4 lb. tartar emetic with 4 lb. sugar, 1 lb. DDT in a wettable powder or emulsified solution, and 1 U.S. quart nicotine sulphate alone, and these all gave significant increases, whereas 1 lb. methoxy-DDT in a wettable powder did not. In 1947, the mixture of DDT and nicotine sulphate, with another adjuvant, again gave the highest yield, but was not significantly better than 1 lb. chlordan, 1 lb. DDT or 1 lb. chlorinated camphene [toxaphene] in emulsions, 5 lb. BHC in a wettable powder, 1 lb. DDT in a wettable powder with 1 U.S. pint hexaethyl tetraphosphate and an adjuvant or 4 lb. tartar emetic with 4 lb. sugar, all of which gave significant increases in yield ; 1 lb. methoxy-DDT and 1 lb. DDT in wettable powders with a spreader and sticker did not give significant increases. The reductions in thrips population were greatest after treatment with the sprays containing DDT or BHC, but these and the numbers of surviving thrips were not very closely correlated with yields, partly owing to great variations in infestation between plants. It is possible that some of the insecticides or auxiliary materials may have affected the growth of the plants directly and that variability in soil fertility may have affected yields. Insecticidal applications were very high owing to the closeness of the plants, totals of 1,200–1,400 U.S. gals. per acre being applied in 1946 and 700–800 U.S. gals. in 1947.

Wene (G. P.). **Control of Turnip Aphids.**—*J. econ. Ent.* **42** no. 1 pp. 73–76, 5 refs. Menasha, Wis., 1949.

An account is given of six series of experiments on the control of *Rhopalosiphum pseudobrassicae*, Davis, which is one of the principal insect pests of cruciferous vegetables in the Lower Rio Grande Valley of Texas. The results showed that dusts containing 1 per cent. parathion or γ BHC (benzene hexachloride) gave excellent control for a fortnight on turnip, mustard greens or radish ; 0·5 per cent. γ BHC did not give good control and 0·25 per cent. parathion gave good initial control but lost its toxicity in 7–14 days. No odour or taste was detected in turnips or radishes eaten one week later. A dust containing 3 per cent. nicotine greatly reduced the Aphid population for three days after application, but the reduction was not sufficient to prevent the population from increasing greatly by the seventh day, and the data indicate that the turnip-growing season is too cool for maximum control with nicotine dusts. The addition of 1 per cent. DDT or 0·5 per cent. piperonyl cyclonene (piperonyl cyclohexenone) increased the toxicity of an impregnated pyrethrum dust (0·1 per cent. pyrethrins), but the control obtained was not good enough for commercial purposes ; an impregnated dust mixture of 0·1 per cent. pyrethrins and 1 per cent. DDT was about as effective as 3 per cent. nicotine seven days after application. The dusts were applied to turnips at 30–35 lb. per acre, except in a strong wind, when the rate was increased to 40 lb. for satisfactory control with the effective dusts, and to radishes and mustard greens at 15 lb.

Ristich (S. S.) & Schwardt (H. H.). **Biology and Control of the Seed-corn Maggot on Beans in New York.**—*J. econ. Ent.* **42** no. 1 pp. 77–80, 3 refs. Menasha, Wis., 1949.

In experiments in New York in 1947–48 on the control of *Hylemyia cilicrura*, Rond., which injures bean, pea and maize seedlings, before the plants emerge, by tunnelling into the cotyledons or damaging the growing tip, coating bean seeds with a 5 per cent. methyl cellulose solution and then at various rates with dusts containing 6 per cent. γ BHC (benzene hexachloride) and 44 per cent. other isomers, 50 per cent. wettable DDT or 5 per cent. chlordan or toxaphene showed little promise. When the dusts were worked into the soil in which the seeds were to be planted, 5 per cent. toxaphene was ineffective, but 5 per cent. chlordan and 3 per cent. γ BHC with or without 25 per cent. other isomers reduced maggot injury, though the effect of BHC lasted only a short time. The chlordan dust was somewhat more effective at 80 than 40 lb. per acre, but the BHC dusts were no more effective at 132 than at 66 lb. per acre. Both insecticides imparted a flavour to dried beans grown in treated soil, though chlordan was not detected consistently. In rearing experiments, pairing and oviposition occurred in the laboratory when the adults were kept in glass cylinders set in a dish and covered at the top with cheesecloth and given 10 per cent. buckwheat honey solution supplemented with moistened fish meal or chopped earthworms. The larvae developed and pupated in a variety of media, which are listed, and several generations were bred.

Deay (H. O.), Patch (L. H.) & Snelling (R. O.). **Loss in Yield of Dent Corn infested with the August Generation of the European Corn Borer.**—*J. econ. Ent.* **42** no. 1 pp. 81–87, 3 refs. Menasha, Wis., 1949.

The following is substantially the authors' summary. In experiments carried out near Lafayette, Indiana, in 1944–46, plots of hybrid maize were infested by hand with varying numbers of egg-masses of *Pyrausta nubilalis*, Hb., to coincide with and supplement the natural infestation of the August generation of the multiple-generation strain. On the basis of the resulting different numbers of larvae per plant, the rates at which the yields were reduced and the potential yields in the absence of borers were estimated by regression methods, and the rates were expressed as percentages of the potential yields.

Single-cross hybrids with potential yields of 45·8–88·5 bushels per acre were tested in 1944 and another lot of single and double crosses with potential yields of 66·8–92·9 bushels in 1945. An average of the results of the two experiments showed that hybrids with potential yields of 66·8 bushels lost 1·21 bushels or 1·81 per cent. of their yield per borer per plant, and this loss increased by linear regression to 2·61 bushels or 2·95 per cent. as the potential yield increased to 88·5 bushels. Under an infestation of ten borers per plant, the 88·5-bushel hybrid would have outyielded the 66·8-bushel hybrid by 7·7 bushels.

In the 1944 experiment, three hybrids involving line Ind.P8 crossed on Ia.L304A, Kan.K230, and Ind.WF9 had their yields reduced by an average of 1·08 bushels per acre by each additional borer per plant compared with 1·57 bushels, the predicted average. In 1945, three hybrids involving line P8 crossed on Ill. Hy, Ind.38–11, and Ind.B2 had their yield reduced by about 1·27 bushels per borer per plant compared with 1·62 bushels for hybrids involving line WF9 crossed on the same lines. Also, four hybrids with P8 crossed on 38–11, B2, WF9 and WF9A had their yield reduced by about 1·11 bushels per borer per plant compared with 2·25 and 3·09 bushels for hybrids having Hy and Ia.L317, respectively, crossed on the same lines. Evidently, line P8 is borer-tolerant in the sense that it has the ability to maintain yield in single-cross combination better than other lines.

In 1945, commercial hybrid Ind.610B planted on 30th May and 11th June had its potential yields of 118·6 and 107 bushels per acre reduced by 1·69 and 2·35 bushels or 1·42 and 2·2 per cent., respectively, per borer per plant. In 1946, the same hybrid planted on 21st and 31st May and 10th June had its potential yields of 123·4, 118·1 and 108 bushels reduced by 1·94, 2·57 and 2·27 bushels or 1·57, 2·18 and 2·1 per cent., respectively, per borer per plant. In 1945, groups of late white single cross hybrids with potential yields of 68·5 and 83·5 bushels per acre had those yields reduced by 2·76 and 2·9 bushels, or 4·03 and 3·47 per cent., respectively. Since the larvae had a longer time to feed in these hybrids than in the others before the critical period of ear production, they would be expected to suffer a greater reduction in yield than the other hybrids.

Apple (J. W.) & Decker (G. C.). **Insecticidal Dust Formulations for Corn Borer Control.**—*J. econ. Ent.* **42** no. 1 pp. 88–92, 4 refs. Menasha, Wis., 1949.

The following is largely based on the authors' summary of this account of tests with dusts, applied with a duster mounted on a detasseling machine unless otherwise stated, against *Pyrausta nubilalis*, Hb., on sweet maize grown for canning in Illinois in 1946–48. Inadequate results were obtained against the first generation, owing to low infestations, but 40 per cent. *Ryania* was considered to be the most effective treatment against the second. Parathion at 2 per cent., applied by aeroplane at 33 lb. per acre, showed exceptional promise against *P. nubilalis* in 1948, but was disappointing against the corn earworm [*Heliothis armigera*, Hb.]. DDT at 5 per cent. was more effective than DDD (dichlordiphenyldichlorethane), chlorinated camphene [toxaphene] or methoxychlor [methoxy-DDT] at the same concentration or rotenone at 1 per cent. Under conditions of light infestation, the use of three different diluents for 5 per cent. DDT did not affect control, and the addition of a packing house byproduct called hemo-serum, soy-bean flour, sulphur or oil or of methylnaphthalene or methylene-chloride solvents did not improve it ; the DDT dust impregnated with 10 per cent. of the non-volatile solvent (methyl naphthalene) gave poorer control. In one test against a moderately high borer infestation, 5 per cent. DDT was more effective in an attapulgite clay than in pyrophyllite or Eastern magnesia talc, and DDT dust containing 2 per cent. hemo-serum gave the best control of the DDT dusts tested.

The maize dusted with 2 per cent. parathion at 33 lb. per acre showed a parathion residue on the foliage of 6·8 parts per million (dry weight) two days after application. The residue was 0·7 p.p.m. (dry weight) 21 days later, and 0·02 p.p.m. (green weight) on silage made from all parts of the plants but the ears 71 days later.

Stitt (L. L.). **Host-Plant Sources of *Lygus* spp. infesting the Alfalfa Seed Crop in southern Arizona and southeastern California.**—*J. econ. Ent.* **42** no. 1 pp. 93–99, 7 refs. Menasha, Wis., 1949.

The following is based on the author's summary. The reduction of seed yields as a result of damage by *Lygus* is an important problem in the areas of southern Arizona and south-eastern California in which lucerne is grown for seed ; the species involved are *L. hesperus*, Knight, *L. oblineatus*, Say, and *L. elisus*, Van D., in descending order of importance [*cf. R.A.E.*, A **29** 441–442]. Data on *Lygus* populations on plants that might serve as sources of the infestation of the main lucerne seed crop were obtained by sweeping in two counties in Arizona and one in California between 1936 and the middle of 1942. In all, 1,195 records were made on 39 separate plant species or mixtures of species,

exclusive of lucerne, and 26,817 *Lygus* bugs were taken in 134,361 sweeps with a 15-inch hand net, an average of 20 bugs per 100 sweeps. The average numbers per 100 sweeps were four on plants growing in a desert habitat and 32·7 on plants in the river valleys, where cultivated crops, including the lucerne seed crop, were grown under irrigation on part of the area. The data obtained indicated that, during years of average rainfall, the desert plants matured or became unfavourable for *Lygus* populations before the main lucerne seed crop became attractive and that dispersals from them took place before that time.

Owing to low *Lygus* populations or to the time of year when they supported infestations, 24 of the 39 plant species or mixtures were not sources of infestation for the main lucerne seed crops. It appeared that practically all infestations of the latter come from cultivated irrigated land in the river valley areas, and that, of the food-plants other than lucerne, only sugar beet, *Polygonum argyrocoleon* and *Sisymbrium irio* are sources of large populations that might migrate at such a time as to affect the development of the seed crop. The control of weeds that are important food-plants of *Lygus* would apparently reduce the populations that affect lucerne grown for seed.

KÔNO (H.). **A New Species of Curculionidae, *Phyllobius intrusus*, injurious in the State of Rhode Island (Coleoptera).**—*Proc. biol. Soc. Wash.* **61** pp. 169–170. Washington, D.C., 1948.

[**A Note on *Phyllobius intrusus*, Kôno.**]—*J. econ. Ent.* **42** no. 1 p. 105. Menasha, Wis., 1949.

Phyllobius intrusus, sp. n., is described from adults of both sexes taken in Rhode Island and in Japan. It has recently been injurious to arborvitae [*Thuja*] in evergreen nursery plantings in Rhode Island.

It is reported in the anonymous note that this weevil has also been found in two counties in Connecticut and four in Massachusetts. It has caused injury to the roots of arborvitae and related conifers.

CARTER (R. H.) & others. **DDT Content of Milk from Cows fed Pea Vine Silage containing DDT Residues.**—*J. econ. Ent.* **42** no. 1 pp. 119–122, 7 refs. Menasha, Wis., 1949.

The following is based on the authors' summary. In 1946, chemical analyses showed that the DDT content of pea plants taken before harvest from fields treated with DDT sprays, dusts and aerosols (propelled by dichlordifluoromethane or methyl chloride) at a rate to give 0·4–0·5 lb. DDT per acre, all of which were effective against *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.), was 0–51 parts per million (dry weight). Aerosols applied at low temperatures left larger amounts of residue than those applied at higher ones. Silage made from some of the plants was found to contain DDT in amounts ranging from 0 to 18·7 p.p.m. (dry weight). Samples of silage bearing 7·7–18·7 p.p.m. DDT were fed to two milk cows daily for two months. Chemical analyses of the milk showed traces of DDT, but less than 0·5 p.p.m., which is near the minimum that can be determined by the colorimetric method. In tests with house-flies [*Musca domestica*, L.], in which the cream was homogenised to make it more digestible, and synthetic creams prepared from butter and skim milk with DDT added were used as a standard of comparison, DDT concentrations of 50 p.p.m. or less could not be definitely detected on the basis of fly mortalities, and as the flies were adversely affected by a cream diet, it appears inadvisable to use *M. domestica* for the biological detection of DDT in milk or to draw conclusions from data so obtained.

Fulton (R. A.), McBride (O. C.) & Sullivan (W. N.). **Toxicity of Residues from Carbon Dioxide-propelled Insecticides.**—*J. econ. Ent.* **42** no. 1 pp. 123–126, 3 refs. Menasha, Wis., 1949.

Carbon dioxide has recently been used as the principal propellent for applying DDT solutions to the baggage compartments of aircraft [since Freon 12 (dichlordifluoromethane), though adequate for producing aerosols, does not give a pressure sufficient for applying a spray containing a high percentage of non-volatile materials designed to leave a toxic deposit]. In this paper an account is given of investigations on the effectiveness and durability of the deposits obtained on surfaces of various types. DDT, with or without other insecticides, was dissolved in a suitable solvent (mainly methylene chloride) and put in a pressure cylinder that had been evacuated. A low percentage of Freon 12 was added to the solution to prevent a decrease in pressure when the container was nearly empty, and the cylinder was then charged with carbon dioxide from a supply tank equipped with a reducing valve and gauge ; the valve was set for a pressure of 180 lb. per square inch, and the container held in an inverted position so that the gas could bubble through the solution. When no more gas entered, the cylinder was put in tap water to cool the contents, causing a drop in pressure to about 140 lb. The valve was reset for 150 lb. and the contents were shaken until there was no deflection in the carbon-dioxide gauge. The solution was applied through oil-burner tips, the most suitable being a 2·5 U.S. gallon per hour, 80° angle unit, which discharges approximately 2·3 gm. solution per second. When the tip was held about 16 inches from the surface and moved in a parallel plane at the rate of 1 foot per second it deposited about 75 mg. DDT per square foot from a 10 per cent. solution. The advantages of this method of application are that the solution is self-propelled, the risk of fire is reduced, undesirable carriers such as oils are not needed, and uniform coverage is obtained with no streaking of the surface that is being treated.

Heavy dosages were used in the experiments, because they are necessary for effective control of agricultural pests. They were applied to panels of masonite and aluminium hung on a wall, and the test insects were exposed to the residues for an hour by confining them on the panels and then transferred to clean cages containing food and water. Three series of tests were made during the initial experiments ; with one application of 75 mg. insecticide per sq. ft. and toxicity tests at ten-day intervals for 30 days ; with two applications of 75 mg. per sq. ft. three days apart and four toxicity tests at intervals of ten days ; and with four applications of 75 mg. per sq. ft. at ten-day intervals and toxicity tests after each application and for 150 days after the last. Chemical analysis of the deposits on aluminium panels showed that they were about 75 mg. DDT for each application in each series. In no case was there an appreciable loss from panels kept at room temperature, but in later studies not reported in this paper, a loss was noted in the interior of an aeroplane, where the temperature reached 180°F.

In tests against *Periplaneta americana*, L., and *Tribolium confusum*, Duv., with aluminium panels, deposits from most of the ten formulations at the single 75 mg. dosage gave good kills on the third day after application but decreased in toxicity as they aged, and after 30 days the effectiveness of eight had decreased by 50–80 per cent. Dosages of 150 mg. gave kills about equal to those from 75 mg. on the third day but showed a smaller decrease in kill over 30 days, and dosages of 300 mg. gave kills about equal to those from 150 mg., but showed little decrease in kill in 150 days. The materials were in general less effective on masonite, which is porous and has an irregular surface. When the four best formulations were tested on aluminium against grasshoppers, *P. americana* and *T. confusum*, a solution of DDT, piperonyl butoxide, pyrethrum

extract, Freon 12 and methylene chloride (10 : 5 : 5 : 20 : 60) was the most effective, followed in order by mixtures of DDT, chlordan, piperonyl butoxide, Freon 12 and methylene chloride (5 : 4 : 5 : 20 : 66), DDT, methylated naphthalenes, acetone, cyclohexanone and Freon 12 (10 : 10 : 65 : 10 : 5) and DDT, methylated naphthalenes, Freon 12 and methylene chloride (10 : 10 : 20 : 60) ; this is the same general order as was found in the earlier tests. On aluminium, the first formula was effective against grasshoppers, *Epilachna varivestis*, Muls., *Popillia japonica*, Newm., *Leptinotarsa decemlineata*, Say, *Epicauta solani*, Werner, and *Periplaneta americana*, but not *Attagenus piceus*, Ol. ; it was again less effective on masonite. A 90 per cent. DDT water-dispersible powder applied as a 10 per cent. spray was effective, but the white blotchy appearance, especially on dark surfaces, would present a problem in aeroplanes.

Kearns (C. W.), Weinman (C. J.) & Decker (G. C.). **Insecticidal Properties of some new Chlorinated Organic Compounds.**—*J. econ. Ent.* **42** no. 1 pp. 127–134, 6 refs. Menasha, Wis., 1949.

The authors summarise preliminary data on the physical and insecticidal properties of 1 (or 3a),4,5,6,7,8,8 - heptachlor - 4:7 - methano - 3a,4,7,7a - tetrahydroindene, a pure compound isolated from technical chlordan by chromatographic absorption and subsequently referred to as **I** ; 1,2,3,4,10,10-hexachlor-1:4,5:8-diendomethano-1,4,4a,5,8,8a-hexahydronaphthalene, referred to as **II** ; and an oxygenated derivative of **II**, referred to as **III**. **I** is an almost odourless white or yellowish white crystalline solid that melts at 92–93°C., is insoluble in water but fairly soluble in most organic solvents, including refined kerosenes, and slowly decomposes with the liberation of hydrochloric acid in the presence of strong alkalis and probably also when exposed to certain metallic halides. **II** is an almost odourless white crystalline solid that melts at 100–103°C., is very highly soluble in most organic solvents but insoluble in water, and is stable in the presence of organic and inorganic alkalis and metallic chlorides even when these materials are in solution with it. **III** resembles **II** in most of its physical properties, but is somewhat less soluble in organic solvents ; its melting point is 173°C., and it is stable to strong alkalis but decomposes in the presence of strong acids.

In spray tests against house-flies [*Musca domestica*, L.] by the wind-tunnel technique [*cf. R.A.E.*, A **38** 96], DDT, chlordan, γ BHC (benzene hexachloride), **I**, **II** and **III** at 0·25 mg. per ml. kerosene gave 23, 37, 97, 98, 93 and 100 per cent. kill in 24 hours, and the median lethal doses when the compounds were dissolved in ethyl alcohol and applied to the thorax of flies lightly anaesthetised with carbon dioxide were 20·5, 4, 2·9, 1·7, 1·6 and 1·1 mmg. per gm. body weight. Deposits (50 mg. per sq. ft.) of **I**, **II**, **III**, DDT and chlordan, applied to glass plates in acetone, gave 100, 83·8, 100, 73·7 and 93·4 per cent. mortality in 24 hours of flies exposed for 30 minutes five days later, and **III** gave over 60 per cent. kill after 51 days, but the others had lost their toxicity after 3–4 weeks. Tests on rapidity of action, in which flies were exposed to deposits for ten minutes, showed that this decreased in the order γ BHC, **II**, **III**, **I**, chlordan and DDT, except that **II** and **III** were about equal. When solutions of the test materials in dioxane were applied to the abdominal sterna of adults of *Periplaneta americana*, L., and males of *Blattella germanica*, L., **III** was slightly more effective than **I**, **II** or γ BHC and definitely more so than chlordan against both species. In tests of light deposits (1 mg. per 1,000 sq. cm.) against *Blattella*, all five compounds showed high initial toxicity, but **III** still gave 100 and 90 per cent. kill with 48 hours' exposure after 42 and 49 days, whereas **I** had lost all toxicity after 28 days and the other compounds after 21.

Counts made 96 hours after treatment showed that the median lethal doses of chlordan, γ BHC, **I**, **II** and **III**, applied in dioxane to the scutellum of adult females of *Oncopeltis fasciatus*, Dall., were approximately 145, 33, 31, 10 and 15 mmg. per gm. body weight. In dust-barrier tests against *Blissus leucopterus*, Say [*cf.* **32** 193], the minimum effective concentration of DNC (dinitro-o-cresol) appeared to be 0·5 per cent., and concentrations of 1–8 per cent. consistently gave complete mortality in 24 hours. DDT, toxaphene, chlordan, γ BHC, **I**, **II** and **III** were also tested and, although it is possible that none of them possesses the physical properties necessary for effective use in dust barriers, the results obtained indicate that γ BHC, **II** and **III** as freshly prepared dusts are equal or superior to DNC in toxicity. BHC approached DNC in speed of action, but the others were less rapid. When small amounts of solutions were applied to full-grown larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., parathion gave complete kill at 0·02–0·35 mg. per gm. body weight, but of the chlorinated hydrocarbons (other than **III**, which was not tested), only DDT at 20–45 mg. per gm. and γ BHC at 2–13 mg. per gm. gave kills appreciably higher than those caused by the solvent alone. It was obvious that the greater toxicity of parathion was related to its far greater speed of action. Larvae treated with it at effective concentrations showed the toxic effects almost immediately, whereas those treated with the chlorinated hydrocarbons appeared normal as soon as the solvent had evaporated and did not die until the pupal stage, if then. It is thought that the greater speed of action of parathion is related to its ability to penetrate the body wall of mature larvae and is not due to a fumigant effect.

When applied at concentrations of 0·01–0·1 per cent. in ethyl alcohol to wool samples subjected to infestation by larvae of *Attagenus piceus*, Ol., and *Tineola biselliella*, Humm., for a fortnight and then reinfested for a week, only DDT and **III** prevented damage by *Attagenus* for three weeks. **I** and **II** were almost as effective during the first two weeks, but showed a marked reduction in toxicity and repellency on reinfestation, and chlordan and γ BHC were less effective except at 0·1 per cent. DDT was much less effective against *Tineola* than against *Attagenus*, and **II** showed the same tendency. Only **III** was almost completely effective against *Tineola* at all concentrations after the second infestation. When the compounds were dissolved in a volatile solvent and intimately mixed with suitable larval food, such as ground dog food, fishmeal and yeast, and the treated food was supplied to a young mated pair of *A. piceus* in a dish, the minimum concentrations that prevented oviposition or the survival of larvae beyond the first instar were 400 parts per million for DDT, 10 for chlordan and **II**, 5 for **I**, 2·8 for γ BHC and 2·5 for parathion. In most tests at effective concentrations, γ BHC and parathion paralysed the adults before oviposition was possible.

In tests against *Conotrachelus nenuphar*, Hbst., peach trees were sprayed with DDT, chlordan, γ BHC and parathion at 2, 0·25–1, 0·15 and 0·15 lb., respectively, per 100 U.S. gals. as wettable powders, and with toxaphene at 2 lb. and **I** and **II** at 0·25–1 lb. per 100 U.S. gals. as emulsified solutions, leaf samples were taken as soon after the leaves had dried or at various intervals after spraying and weevils were caged with them. All materials showed high toxicity when the leaves were removed on the day of spraying, though DDT and toxaphene were the least effective and **I** and **II** were substantially more effective than chlordan at 0·25 and 0·5 lb., but only **I** and **II** at 1 lb. gave appreciable mortality when the deposits were three days old.

DDT, γ BHC and **II**, dissolved in acetone and dispersed in water with a wetting agent at a concentration of 1 : 500, gave about 20 per cent. mortality of the mobile stages of *Tetranychus bimaculatus*, Harvey, on excised rose leaves but had no apparent effect on eggs and resting stages. Chlordan and **I**,

similarly applied, produced an initial kill of 30–50 per cent. and seemed to leave a toxic residue, especially to hatching larvae and mites newly emerged from the resting stage. **III** caused no immediate mortality but killed 100 per cent. of the mobile stages in three days at 1 : 500 and 85 per cent. at 1 : 1,000 ; scarcely any living larvae or resting stages could be found on the leaves 4–5 days after treatment. None of these compounds shows much promise as an acaricide, since even **III** was slow in action at concentrations greater than would be practical under most field conditions, but it seems likely that applications of **III** and possibly **I** may not lead to serious infestations of mites.

The results are also included of tests on adults of *Melanoplus differentialis*, Thos. [see next abstract]. These showed that **I, II** and **III** are about six times as toxic as chlordan in contact action and 3–4 times as toxic as stomach poisons, that they are less toxic than parathion in contact effect, but more so as a stomach poison, and that γ BHC is intermediate in toxicity between them and parathion by both methods.

Weinman (C. J.) & Decker (G. C.). **Chlorinated Hydrocarbon Insecticides used alone and in Combinations for Grasshopper Control.**—*J. econ. Ent.* **42** no. 1 pp. 135–142, 1 graph, 4 refs. Menasha, Wis., 1949.

The following is partly based on the authors' summary. During 1948, various new insecticides, including 1 (or 3a),4,5,6,7,8,8-heptachlor-4:7-methano-3a,4,7,7a-tetrahydroindene (referred to as **I** [*cf.* preceding abstract]) and 1,2,3,4,10,10 - hexachlor - 1:4,5:8 - diendomethano - 1,4,4a,5,8,8a - hexahydro - naphthalene (referred to as **II**), were tested in small field plots in Illinois as sprays against grasshoppers, mainly *Melanoplus differentialis*, Thos., in comparison with chlorinated camphene [toxaphene] and chlordan, which gave very satisfactory results in commercial practice in 1947 and 1948. In two series of tests at Lincoln, none of the materials gave high reductions in population, owing to rapid reinfestation from the surrounding control plots, but an emulsified solution of **II** at 0·5 lb. actual ingredient per acre showed promise in the first. In a further test at LeRoy, where the plots were fairly well protected from reinvasion, the percentages by which the numbers of large nymphs were reduced in 12 days, based on comparison with adjacent areas, were 69·1, 75 and 81·8 for 0·25, 0·5 and 1 lb. chlordan per acre, 92·7 for 2 lb. toxaphene, 43·6 for 2 lb. DDT, 88·7, 79·2 and 90 for 0·125, 0·25 and 0·5 lb. **I**, 100, 96·9 and 100 for **II** at the same rates, 59·1 (97·5 after 1 day) for 0·3 lb. parathion, 25 (86·4 after 1 day) for 1 lb. hexaethyl tetraphosphate, 84·9 and 78·1 for 2 lb. of mixtures of DDT and chlordan (7 : 1 and 3 : 1, respectively), and 75 and 100 for 2 lb. of mixtures of DDT and **I** and DDT and **II** (15 : 1), all applied as emulsified solutions, and 74·5 for 1 lb. chlordan, 75 for 0·6 lb. γ BHC (benzene hexachloride) and 87·5 (100 after 7 days) for 0·25 lb. **II**, as wettable powders. No evidence of repellent action could be detected when plants were heavily sprayed with **II** or parathion. Greenhouse cage tests with deposits of **II** on lucerne indicated that the toxic action began to decrease after 10–14 days and had almost disappeared after 21 days.

All the compounds tested in the field and **III** (an oxygenated derivative of **II**) were included in laboratory tests designed to give the median lethal doses as contact and stomach poisons. Parathion, with a median lethal dose of 0·8 mmg. per gm. body weight, showed the greatest contact toxicity, followed closely by **III, I, II**, γ BHC and tetraethyl pyrophosphate (which was tested in the field only at Lincoln) in that order. As a stomach poison, **II** was the most toxic (with a median lethal dose of 2·3 mmg. per gm.), with **III, I**, γ BHC and parathion falling in the same range.

Tests of combinations of certain of the chlorinated hydrocarbons indicated no strong synergism or antagonism, although some evidence of slight synergism

was apparent in mixtures of DDT and chlordan and of DDT and **II**; within the narrow limits of this experiment, the greater the ratio of DDT to chlordan or **II**, the greater the synergism, at least in contact effect.

FROST (S. W.). **Flea Beetles attacking Cruciferae.**—*J. econ. Ent.* **42** no. 1 pp. 144–145, 2 refs. Menasha, Wis., 1949.

The flea-beetles that attack crucifers in Pennsylvania were investigated at State College in 1947 and 1948 by sweeping cultivated crops (cabbage, radish and turnip) and a weed (*Barbarea vulgaris*). The species found were *Phyllotreta aerea*, Allard, which was the commonest flea-beetle on the crops but rare on the weed, *P. striolata*, F. [*cf. R.A.E.*, A **37** 414–415], which was common on the weed but not on the crops, *Psylliodes punctulata*, Melsh., and *Epitrix cucumeris*, Harr., which were uncommon on both, and *Chaetocnema pulicaria*, Melsh., which was infrequent.

P. aerea, the adult of which is described, is a European species that was first observed in North America about 1926 and has been recorded on crucifers in New York, Pennsylvania and Michigan [*cf.* **14** 472; **19** 452; also **36** 167]. It causes much injury to young plants in the spring and increases in numbers during the summer, injuring radishes, turnips and young cabbages during the summer and mature cabbages in late autumn, when the adults congregate for hibernation. No examples were swept from tomato or egg-plant [*Solanum melongena*], although other flea-beetles were taken in large numbers.

Other species of *Phyllotreta* that attack crucifers in North America include *P. pusilla*, Horn, and *P. albionica*, Lec., which seem to be the common species on cabbage in the western United States and Canada, *P. oregonensis*, Crotch, which is known only from Oregon and attacks turnip, radish and wild crucifers, while the larvae mine the leaves of *Lepidium*, *P. utana*, Chitt., a western species that has been taken on mustard and beet, *P. undulata*, Kutsch., a northern species that feeds chiefly on mustard, and *P. zimmermanni*, Crotch, *P. liebecki*, Schaeffer, and *P. aenicollis*, Crotch, which have been recorded chiefly from the southern United States. *P. zimmermanni* and *P. bipustulata*, F., which is common on *Barbarea vulgaris* in the eastern United States, have been taken in Pennsylvania.

MADDOCK (D. R.). **Thrips infesting Tomatoes and their Occurrence on other Hosts.**—*J. econ. Ent.* **42** no. 1 p. 146. Menasha, Wis., 1949.

Thrips are important pests of tomato in Utah and have caused concern by contaminating the canned product [*cf. R.A.E.*, A **38** 74]. Of 52 collections of thrips from tomato plants in northern Utah, *Frankliniella moultoni*, Hood, occurred in 45, *Aeolothrips fasciatus*, L., which is predacious, in 18, *Thrips tabaci*, Lind., in 13, *Anaphothrips obscurus*, Müll., in three and *T.* (*Microcephalothrips*) *abdominalis*, Cwfd., in one. In investigations of food-plant range, 378 collections were made from 109 plants representing 39 families. These showed that *F. moultoni* and *T. tabaci* occurred on one or more plants in nearly every family and that *Aeolothrips fasciatus* occurred on a wide range of plants, the kind of plant being apparently less important than the presence of numerous other thrips on which it preys. *Anaphothrips obscurus* and *T. abdominalis* were collected on only 3–4 other species of plants, and their presence on some of these and on tomato was probably accidental. Since *F. moultoni*, *T. tabaci* and *Aeolothrips fasciatus*, the commonest species on tomato, occur on such a wide range of plants, their effective control by weed eradication is particularly difficult, but their abundance in tomato fields could probably be reduced by improved weed control.

LANGFORD (G. S.) & GILBERT (E.). **The Value of Phenyl Ethyl Acetate as an Ingredient in Japanese Beetle Baits.**—*J. econ. Ent.* **42** no. 1 pp. 146–147. Menasha, Wis., 1949.

Field experiments were carried out in Maryland during three years in an attempt to improve the bait combinations used against the Japanese beetle [*Popillia japonica*, Newm.]. The results showed that baits containing phenyl ethyl acetate, eugenol and geraniol (8 : 1 : 1 and 1 : 1 : 8) were 8 and 30 per cent. more effective, based on the numbers of beetles caught, than geraniol and eugenol (9 : 1), whereas phenyl ethyl acetate and eugenol (8 : 2 and 1 : 9) and phenyl ethyl acetate and geraniol (8 : 2) were 28, 1 and 16 per cent. less so, and that anethole, eugenol and phenyl ethyl acetate (8 : 1 : 1) was 33 per cent. more effective than anethole and eugenol (9 : 1). Phenyl ethyl acetate was thus a satisfactory major constituent of baits containing both geraniol and eugenol and improved the attractiveness of baits of geraniol and eugenol and of anethole and eugenol when added as a minor ingredient.

ASQUITH (D.). **European Fruit Lecanium on Peach following Applications of DDT.**—*J. econ. Ent.* **42** no. 1 pp. 147–148. Menasha, Wis., 1949.

In early August 1948, *Eulecanium* (*Lecanium*) *corni*, Bch., was numerous on peach trees in several orchards in Arendtsville, Pennsylvania, of which all had received one or more applications of DDT for the control of other insects and several had been treated with BHC (benzene hexachloride) against the plum curculio [*Conotrachelus nenuphar*, Hbst.]. In all cases adult scales were found on the 1948 growth as well as on the older wood, indicating either that there had been a hatch of eggs earlier in the season or that some of the overwintering scales had moved to new growth. Large numbers of adults were found on weeds growing inside orchard areas that had been sprayed with DDT alone or with BHC. The Coccid had been observed on peach in Pennsylvania before growers began to use DDT and BHC, but it was always so heavily parasitised that it was not of economic importance.

Since the honeydew excreted by the Coccids led to a heavy growth of sooty mould on the fruits, three emergency spray treatments were applied to one orchard on 3rd August in an attempt to stop its production. Amounts are given per 100 U.S. gals. A spray of 1 U.S. quart nicotine sulphate with 4 oz. wetting agent stopped the excretion of honeydew almost completely within two hours and prevented it almost completely until 14th August, when it began again. DDT (1 U.S. quart 25 per cent. emulsion concentrate) reduced the excretion appreciably within 48 hours, but caused no improvement after the initial reduction, and 1·3 U.S. pints of a mixture containing 9 per cent. tetraethyl pyrophosphate and 41 per cent. other organic phosphates was not effective enough to warrant further consideration. On 16th August, all plots were treated with the nicotine-sulphate spray, and excretion of honeydew again ceased soon after. In the plot originally treated with nicotine sulphate, no new deposits of honeydew were seen during the rest of the season, and this was verified in other parts of the orchard that received two applications of the nicotine-sulphate spray.

Between 14th and 16th August, counts of the eggs from 25 scales showed an average of 950 per scale. The crawlers hatched in the orchards between 20th August and 15th September and moved to the leaves, most of them settling on the undersides along the mid-ribs. Later, young scales were observed on the leaves of sweet and sour cherry and apple near infested peach orchards, having apparently been carried by wind. During the season, adults were observed on 24 plants, including 16 weeds that had made all their aerial growth in 1948, and young scales were observed on all these plants and an additional

eight. Young scales were seen moving back to the wood for the first time on 4th October, but this movement did not become general until 20th October.

DOMINICK (C. B.). **New Insecticides for Tobacco Flea Beetle Control.**—*J. econ. Ent.* **42** no. 1 pp. 148–149, 1 ref. Menasha, Wis., 1949.

In 1947, several of the newer organic insecticides were compared with DDT for the control of *Epitrix hirtipennis*, Melsh., on seedling tobacco in plant beds in Virginia [*cf. R.A.E.*, A **37** 334]. The treatments were applied three times, when the plants had 2–4 leaves, when they were 2–3 ins. high and just after the plant-bed covers were removed, the spray materials, which were all in the form of wettable powders, being added to the regular fungicide sprays of 3 lb. ferric dimethyldithiocarbamate per 100 U.S. gals. water, and the results were estimated on 21st May, when most of the plants were six inches high. In the sprays, the addition, per 100 U.S. gals., of 1 lb. DDT, methoxy-DDT (methoxychlor), toxaphene or chlordan, 8 oz. DDT or 2 oz. γ BHC (benzene hexachloride, from a mixture of 5 per cent. γ and 37 per cent. other isomers) increased the percentages of uninjured plants from 17 in the control to 98, 91, 94, 86, 94 and 94, and a 3 per cent. DDT dust increased the percentage to 89. The BHC spray injured about 25 per cent. of the seedlings, but the other materials caused no injury.

In a test later in the season in which the insecticides were applied to the plant beds a few hours before the tobacco was pulled for transplanting, the addition to the fungicide spray of 1 lb. DDT, methoxy-DDT, toxaphene, or chlordan or 2 oz. γ BHC per 100 U.S. gals. caused 98, 97, 94, 65 and 90 per cent. reductions in population three days after transplanting, and 3 per cent. DDT dust caused 92 per cent. reduction. Populations continued to be lower on plants from treated beds for the 12 days during which observations were made, and the average numbers of leaf punctures on the most injured leaves were less than half in most cases. These results indicate that treatment before transplanting, which saves the time and labour involved in making field treatments, is a satisfactory method of controlling *E. hirtipennis* on newly set tobacco. BHC caused slight injury to the plants, but they outgrew this later, and treated plants were all further advanced than untreated ones after a fortnight.

Small-scale phytotoxicity tests in which 1, 2 and 4 lb. DDT and 2 oz. γ BHC were added to sprays of 3 lb. ferric dimethyldithiocarbamate per 100 U.S. gals. water applied to the plant beds seven times between 25th April and 27th May showed that 1 lb. DDT caused no injury, 2 lb. DDT caused slight injury on 6th May, after the third application, and 4 lb. DDT caused more extensive injury ; no injury attributed to DDT was noted on 27th May, and all these plants were comparable in growth and appearance with untreated ones. At least 40 per cent. of the plants treated with BHC were affected and showed moderate spray injury on 27th May.

GRESSITT (J. L.) & FLANDERS (S. E.). **New Developments in the Transport of beneficial Insects.**—*J. econ. Ent.* **42** no. 1 p. 150, 2 refs. Menasha, Wis., 1949.

The authors describe methods now used for the transport of insects to be used in biological control. They are sent by air in frequent small shipments, as this minimises losses due to accidents, and repeated introductions increase the chances of successful propagation and establishment of an introduced species. Since the time in transit from almost any part of the world is now less than the life-cycle or adult life-span of any insect likely to be involved, there is no need to transport food-plants of hosts or convey the adults in cold storage, but the maintenance of environmental conditions suitable for the continued

development of immature insects and the survival of adults in transit is still essential.

Parasites and predators of various pests of *Citrus* were sent from China to California in small boxes of a local wood that is light in weight and spongy but tough. These were tied in bags of durable tightly woven cloth and enclosed in manilla envelopes. Food was included for adult parasites and predators and sufficient food-plant material to keep the hosts alive for at least part of the time required to reach the destination when parasitised scale insects were sent, unless the plants could not legally be imported. These shipments were highly successful as measured by the number of species introduced and propagated. These included parasitic Hymenoptera of the genera *Aspidiotiphagus*, *Aphytis* and *Casca*, which are apparently of value in controlling *Aonidiella aurantii*, Mask., in China.

SIEGLER (E. H.) & GERTLER (S. I.). **Laboratory Tests of some aliphatic N-substituted p-Nitrobenzamides against the Codling Moth.**—*J. econ. Ent.* **42** no. 1 pp. 151–152, 1 ref. Menasha, Wis., 1949.

In tests on newly hatched larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., by the apple-plug method [*cf. R.A.E.*, A **23** 174], nine aliphatic N-substituted paranitrobenzamides, used at a concentration of 4 lb. per 100 U.S. gals. 20 per cent. ethyl alcohol, were compared with lead arsenate at the same concentration and DDT at 12 oz. per 100 U.S. gals. of the carrier. None of the benzamides was promising when compared with DDT, but N,N-diisopropyl-p-nitrobenzamide and N,N-dipropyl-p-nitrobenzamide were slightly more effective than lead arsenate under the conditions of the test [*cf.* **37** 475].

MITCHENER (A. V.). **Chlorinated Camphene, Chlordan, DDT and Calcium Arsenate compared for Control of the Colorado Potato Beetle.**—*J. econ. Ent.* **42** no. 1 pp. 152–153. Menasha, Wis., 1949.

The tests described were carried out in 1948 in Manitoba, where *Leptinotarsa decemlineata*, Say, reduces the potato crop every year. Wet weather delayed planting, and the potato plants did not appear above ground until about the end of June. Sprays prepared from 50 per cent. chlorinated camphene [toxaphene], 40 per cent. emulsifiable technical chlordan, 50 per cent. wettable chlordan powder and 50 per cent. micronised DDT concentrate, each used at the rate of 0·5 lb. pure compound per 40 gals. water, and calcium arsenate at 1·5 lb. per 40 gals., applied to small plots on 13th July at about 58 gals. per acre, when adults and larvae less than a week old were abundant on the foliage, reduced the numbers of larvae per plot present on the following day from 750 (on untreated plots) to 2, 9, 15, 9 and 110, respectively ; there were few adults on any of the sprayed plots. On 6th August, some of the plots had become so badly reinfested with larvae that a second application of the respective sprays was made, and on 7th August, all sprayed plots but those receiving calcium arsenate were practically free of larvae. Adults appeared in the untreated plots at about the beginning of the second week of August and dispersed to all plots before the middle of the month, but none of the females that were dissected contained eggs.

None of the insecticides injured the foliage, and plants sprayed with toxaphene appeared to be slightly greener than any others. The yields from plots treated with toxaphene, wettable chlordan and DDT were 320·8, 317·2 and 314·7 bushels per acre, with no significant difference between them. Emulsifiable chlordan was less effective (278·8 bushels) but more so than calcium arsenate (224·9 bushels), and the yield on untreated plots was 83·7 bushels. None of the insecticides impaired the flavour of the boiled tubers.

Conklin (J. C.) & Walker (G. L.). **Parathion in early Spring Applications for Bud Moth Control.**—*J. econ. Ent.* **42** no. 1 pp. 153–154. Menasha, Wis., 1949.

Spilonota ocellana, Schiff., has been increasing in apple orchards in New Hampshire for several years and caused extensive damage in several commercial orchards in 1947, as much as 75 per cent. of the fruit in certain blocks showing injury at harvest. In the spring of 1948, apple branches bearing overwintering larvae of *S. ocellana* were brought into the laboratory and forced under greenhouse conditions until the buds had partly opened and larval activity was first observed, or until the fruit buds had reached the pink stage and all the larvae had left the hibernacula and begun feeding, and were then sprayed with 2 or 4 lb. 15 per cent. wettable parathion powder per 100 U.S. gals. water, which resulted in complete kill of all larvae, including those still in hibernacula.

In field tests, heavily infested apple trees were treated with approximately 10 U.S. gals. spray per tree from two single gun nozzles, one on a tower mounted on the spray tank and the other from a low platform attached to the rear of the tank. Sprays of 2 lb. 15 per cent. wettable parathion or 2 lb. dinitro-o-cresol per 100 U.S. gals., applied on 7th April, when the trees were in the delayed dormant stage, resulted in 6·4 and 39·4 per cent. of the buds being injured by the larvae, and sprays of 2 lb. 15 per cent. parathion or 1 U.S. quart nicotine sulphate, the latter with 2 U.S. gals. oil, per 100 U.S. gals., applied on 12th April, when the trees were somewhat further advanced in bud development, but the larvae still in their hibernacula, resulted in 4·5 and 27·5 per cent. injured. In a third test, the trees were sprayed on 4th May, when they were in the prepink stage and most of the larvae had left their hibernacula and were feeding on the buds. Many of them were hidden within the buds, where they would be expected to be more difficult to reach with the insecticide, but counts of larvae in buds showing injury on 10th May indicated that 96·8 per cent. were dead on trees treated with 1·2 lb. 25 per cent. wettable parathion with 7·5 lb. wettable sulphur per 100 U.S. gals., and 34·8 per cent. on trees receiving 1·5 U.S. pints nicotine sulphate, 3 lb. lead arsenate and 7·5 lb. wettable sulphur per 100 U.S. gals. Trees that had received the parathion were free of new injury on 8th June, whereas foliage injury was severe and active larvae numerous on trees that had received the other spray. It is concluded that parathion affords satisfactory control and that the best time of application is probably at the prepink stage of bud development.

Sooter (C. A.) & Muma (M. H.). **Rye Jointworm doing Damage in Nebraska.**—*J. econ. Ent.* **42** no. 1 p. 154. Menasha, Wis., 1949.

In the summer of 1946, moderate to heavy lodging of rye occurred near Atkinson in Holt County, Nebraska, and serious local losses were reported. Six samples of culms were collected in the infested area on 13th August, and 6–36 per cent. of the culms in four of them bore galls of *Harmolita secalis*, Fitch; there was an average of 15 per cent. infestation for all samples. The outbreak appeared to be localised in the vicinity of Emmet, Atkinson and Stuart, in the north-west of the county. A survey on 25th and 26th June 1947 showed an average of 23·5 per cent. infestation in all samples from the area immediately north and west of Atkinson, the lightest infestation being 14 per cent. and the heaviest 56 per cent., and infestations were also found in Emmet and O'Neill in Holt County and near Bassett in Rock County. There was an average of 3·32 galls per infested culm in the Atkinson area and 0·78 per culm in all the samples collected.

It is expected that general losses will continue unless the practice of continuous rye cropping on the same or adjoining land is changed. The need

for conservation of soil and moisture does not permit control by burning the straw or ploughing it under.

Chisholm (R. D.), Nelson (R. H.) & Fleck (E. E.). **The Toxicity of DDT Deposits as influenced by Sunlight.**—*J. econ. Ent.* **42** no. 1 pp. 154–155, 4 refs. Menasha, Wis., 1949.

In the experiments described, the technique of which is noticed in more detail elsewhere [*R.A.E.*, B **38** 56], sprays of DDT in water suspensions or emulsified solutions were applied to glass plates so that a uniform deposit of 3 mg. DDT per sq. ft. was obtained. Some of the plates were kept continuously in the dark and others were exposed in the open on bright summer days for total periods of 32 or 64 hours and kept in the dark at other times. Some months later, the toxicity of the deposits to *Musca domestica*, L., was tested. Under the conditions of the experiment, the mean mortality percentages for a standard suspension of 1 lb. DDT, 1 lb. pyrophyllite and 4 oz. emulsifier per 100 U.S. gals. were 48·8 after continuous storage in the dark and 41·8 and 33·8 after storage including exposure to sunlight for 32 and 64 hours. When high-calcium hydrated lime, high-magnesium hydrated lime, micronised sulphur, a clay or bordeaux mixture (which are often included in agricultural sprays) was added to the standard suspension, toxicity after exposure to sunlight was very much lower than after continuous storage in the dark. The difference was greatest in the case of the limes and bordeaux mixture and smallest for sulphur. The effect of adding a dust conditioner (limonite), which was considered representative of iron impurities sometimes found in sprays or on sprayed surfaces, was somewhat similar to that of adding sulphur. The bordeaux mixture had a deleterious effect even when the deposit was not exposed to sunlight.

The DDT deposits from the emulsified solutions caused much lower mortalities than those from suspensions, even when the plates were stored in the absence of sunlight ; after exposure to sunlight for as little as 32 hours, mortality from nearly all of them was negligible. Deposits from emulsified solutions in kerosene and xylene to which had been added aluminium powder or titanium dioxide, both of which reflect sunlight, or carbon black or diethylaniline, which absorb it, were all negligible in toxicity after exposure to sunlight, but the spray containing carbon black alone among the emulsions gave a kill comparable with that given by the suspensions in the shorter exposure period after storage in the dark.

Bronson (T. E.), Stone (P. V.) & Allen (T. C.). **Field Experiments with Hexaethyl Tetraphosphate for Cabbage Aphid Control.**—*J. econ. Ent.* **42** no. 1 pp. 156–157, 2 refs. Menasha, Wis., 1949.

In field experiments in Wisconsin in 1946 on the control of *Brevicoryne brassicae*, L., on cabbage, dusts containing 3 per cent. HETP (hexaethyl tetraphosphate) in pyrophyllite or 5 per cent. in talc, an aerosol from a solution containing HETP, a mixture of di- and tri-methylnaphthalenes, trichlorethylene and methyl chloride (5 : 5 : 40 : 50) and sprays containing 0·12 or 0·06 per cent. HETP with an emulsifier were compared with a dust containing 3 per cent. nicotine and a spray containing nicotine sulphate and a phthalic glyceryl alkyl resin (0·1 per cent. nicotine). All the HETP preparations were applied soon after being mixed, since they deteriorate rapidly. The dusts were applied at 35 lb. per acre from a power duster without an apron or hood, the sprays at

100 U.S. gals. per acre, and the aerosol at 16 lb. per acre from 12 oil-burner nozzles, each capable of delivering 2 U.S. gals. per hour, on a 12-foot broadcast-type boom ; the nozzles released the aerosol within an enclosed hood to which a muslin apron ten feet long was attached.

In the first test, HETP as a 3 per cent. dust, an aerosol and a 0·06 per cent. spray and the nicotine spray gave 98, 96, 86 and 77 per cent. control in 24 hours ; in the second, HETP as a 3 per cent. dust and a 0·12 per cent. spray and the nicotine dust and spray gave 92, 99, 76 and 78 per cent. ; and in the third, HETP as a 5 per cent. dust and a 0·12 per cent. spray and the nicotine dust and spray gave 99·7, 99·5, 87 and 41 per cent. Although HETP was most effective as a dust in the first experiment, the dosage as a dust was about twice that as a spray and slightly higher than that as an aerosol. In the second, when the strength of the spray was adjusted so that it and the dust both applied about 1 lb. pure chemical per acre, it was superior to the dust. In the third experiment, about 75 per cent. more HETP was applied as a dust than as a spray, and both were very effective, especially in protected areas of the plant where it is difficult to obtain good coverage. Untreated plots were heavily infested.

After repeated use, the porcelain lining of the pump cylinders became rather badly etched by the HETP. This rough surface wore the pump leathers rapidly, and it was necessary to replace them after every 2–3 hours of operation. Some aerosol nozzles became clogged, perhaps by residues resulting from chemical action of the HETP on the tanks or fittings.

Garman (P.) & Kennedy (B. H.). **Effect of Soil Fertilization on the Rate of Reproduction of the Two-spotted Spider Mite.**—*J. econ. Ent.* **42** no. 1 pp. 157–158, 3 refs. Menasha, Wis., 1949.

The authors discuss the effect of variations in plant vigour on populations of phytophagous mites and describe experiments to determine whether plants in poor growing condition harbour fewer mites than more vigorous ones. Single adult females of the two-spotted spider mite [*Tetranychus bimaculatus*, Harvey] were caged on the leaves of bean plants grown in potted soil, and their progeny subsequently counted. The averages per female were 79 and 23·2 after three weeks on plants grown in heavily fertilised soil and unfertilised soil, respectively, in three series of tests, and 36·4 and 26·2 on plants in fertilised and unfertilised soil, respectively, after two weeks in four series of tests. It was evident that soil variations caused considerable variation in results, and sand cultures were used in later tests. In these, the population per female after 21 days averaged 129·09 on beans grown in sand treated with a water-soluble fertiliser containing nitrogen, phosphoric acid and potash with other elements and vitamins B_1 and B_2, and 14·5 on those in unfertilised sand ; 31·55 and 11·92 after 14 and 15 days in two tests on beans in sand treated with a fertiliser containing magnesium sulphate, calcium nitrate, potassium acid phosphate and potassium nitrate and 16·08 and 8 on beans in untreated sand ; and 103·4 and 126·6 after 20 and 14 days in two tests on peach plants grown in sand treated with a fertiliser containing magnesium sulphate, calcium nitrate, calcium phosphate and potassium nitrate with traces of ferric chloride, boric acid, copper sulphate and potassium permanganate and 53·4 and 96·2 on peaches growing in untreated sand.

It is obvious that heavy populations develop on either plant if it is heavily fertilised, and it is concluded from these results and from evidence in the literature that mite populations may easily fluctuate with the variable vigour of the food-plant, due to heavy or light fertilisation.

Hammond (G. H.). **The Distribution, Life-history and Control of *Phyllophaga anxia* Lec. in Quebec and Ontario.**—*Sci. Agric.* **28** no. 9 pp. 403–416, 2 figs., 34 refs. Ottawa, 1948.

The following is substantially the author's summary. Early records of damage by species of *Lachnosterna* (*Phyllophaga*) in Quebec and Ontario were very irregular and are too few to give an accurate picture of the actual damage and crop loss experienced. Throughout Quebec and much of Ontario, the principal species concerned is *L.* (*P.*) *anxia*, Lec., with several additional species in central and south-western Ontario [*R.A.E.*, A **29** 89]. *L. anxia* is found in every province of Canada, including Newfoundland, and some parts of the Northwest Territories. It is a hardy species and occurs as far north at least as the known limits of agriculture. All species of *Lachnosterna* found in eastern Canada have a three-year life-cycle, and these cycles do not overlap in any one area [**28** 425]. However, the life-history stages do not occur in the same rhythm in all areas, and these different rhythms are known as "broods", each confined within fairly definite geographical limits [**25** 367]. There are three broods in Quebec and two in Ontario, but regardless of the brood development or the species, the second-year larva is the most destructive stage in the life-history. Both the adults and larvae feed on a great variety of plants and the intensity of infestation is closely linked with soil type [**25** 368; **28** 426]. Shallow ploughing followed by multiple disking of the soil [**23** 234] is still recommended as the principal control measure to destroy the larvae before they reach their most injurious phase. Injury can be avoided by suitable, short-term crop rotations [**29** 90], the switching of susceptible crops to heavier soils, the use of clovers instead of timothy grass [*Phleum pratense*] for hay [**21** 515; **23** 334], and clean cultivation. Planting sugar maple [*Acer saccharum*] round dwellings and along highways is recommended instead of oak, ash, poplar or American elm [*Ulmus americana*], since it attracts the adults less. Chlorpicrin [**35** 10] or other volatile soil fumigants are effective control agents, but the cost is relatively high. DDT and benzene hexachloride have both shown promise as soil insecticides against the larvae in rough pastures, where other treatments have proved impracticable.

Fox (W. B.). **2,4-D as a Factor in increasing Wireworm Damage of Wheat.**—*Sci. Agric.* **28** no. 9 pp. 423–424, 1 ref. Ottawa, 1948.

Damage to wheat by *Ctenicera aeripennis destructor*, Brown, is accentuated when the germination or early growth of the plants is retarded by drought, low temperature, deep sowing, or treatment of the seeds with formalin for smut control. In the course of experiments in Saskatchewan in 1947, two plots were sprayed on 15th May with 2,4-D (2,4-dichlorphenoxyacetic acid) at rates of 1 and 2 lb. per acre for the control of weeds and sown in strips with wheat and other crops on 16th May and 2nd June. Casual observation on 15th June indicated more wireworm damage to emerged wheat plants in the treated plot than in the control and examination showed that though the wheat kernels sown on 16th May had disintegrated too far for wireworm damage to be estimated, about three times as many of those sown on 2nd June had failed to germinate owing to wireworm injury as in the control. The percentages of the emerged plants killed by wireworms were 31 and 27 for 1 and 2 lb. 2,4-D, respectively, as compared with 5 in the control, for the earlier sowing, and appeared about the same for the later one, though the immaturity of the plants rendered accurate counts impossible. Both the germination and the rate of growth of the wheat were retarded in the treated plots. Wheat sown in further strips on 17th June and 3rd July suffered little damage,

presumably because the period of maximum wireworm activity had passed. If these findings are confirmed, it will be necessary to exercise care in applying weed-killers shortly before or after sowing in fields infested with wireworms.

GLENDENNING (R.) & FULTON (H. G.). **Experiments in Control of the Carrot Rust Fly** (*Psila rosae* **L.**).—*Sci. Agric.* **28** no. 12 pp. 545–553, 2 pls., 1 fig. Ottawa, 1948.

Naphthalene and a dust containing 4 per cent. mercurous chloride (calomel) in talc are recommended against *Psila rosae*, L., on carrots in British Columbia [*R.A.E.*, A **35** 366], but since they are costly, have to be applied several times and do not give more than 75–85 per cent. control, experiments were made with BHC (benzene hexachloride). A dust of 20 per cent. partly deodorised BHC (2 per cent. γ isomer) in gypsum, further diluted with pyrophyllite to contain 0·5 per cent. γ isomer, was used in all of them. In preliminary tests in 1946, it was applied to the foliage and soil along the rows at a rate of 1 lb. per 200 ft. of row on 16th and 25th July and 7th August against the second generation. Owing to hot weather, infestation by this generation was very low, but counts on 1st October showed that the percentages of carrots infested by the third was reduced from 40–70 for various other treatments (unspecified) and the controls to 14, and injury was negligible. On 5th November, the percentages of carrots injured averaged 16 for BHC and 75–95 on the other plots, on which damage was severe.

In 1947, the BHC dust was compared with naphthalene applied as the crude product and in the form of moth balls in experimental plots at two places (Chilliwack and Sardis) on similar soils. The BHC was applied at a rate of 11 oz. diluted dust per 100 ft. of row (1 lb. γ isomer per acre) to the open drill before sowing or to the foliage ; in the latter case, 1–3 applications were made at intervals of ten days. Crude naphthalene was applied at 1 lb. per 100 ft. four times at weekly intervals. Moth balls were placed 8 ins. apart in alternating rows, one on each side of the carrot row, and were used at a rate of 1·75 lb. per 100 ft. of row. At Sardis, stove oil applied twice at an interval of 12 days at a rate of 0·5 gal. per 100 ft. of row was also tested. With the exception of BHC in the drill, all treatments were first applied on 24th April, when adults of the overwintered generation had begun to emerge. The seedlings were then only 2 ins. high, and most of the dust applied to the foliage fell on to the soil. By 11th–12th June, infestation in the control plots averaged 91·7 per cent. and many seedlings had died. In the plots treated with moth balls it averaged 39·7 per cent., but was mostly at the tip of the tap roots, so that damage was not very severe and the foliage did not wilt. In the plots treated with BHC, it averaged 2·2 per cent. for the soil treatment and 0·5–1·2 per cent. for 1–3 foliage applications, and the roots were in all cases undamaged. Plants sprayed with stove oil were free from infestation. The flavour of carrots taken at this time from the plots treated with BHC was somewhat impaired, but the tainting disappeared on cooking, except for the soil treatment. In carrots dug in July, tainting was discernible only in the case of the soil treatment.

The plots were examined for infestation by second-generation larvae on 3rd–6th September, when all those treated with BHC were free from infestation, as compared with 56, 58·7 and 44·4 per cent. infestation in the plots treated with crude naphthalene, moth balls and stove oil, respectively, and 62·8 in the controls. In previous years, second-generation larvae fed chiefly in the lateral roots, causing wilting and russetting of the foliage, but little injury to the tap root ; in 1947, they fed mostly by tunnelling in the tap root. About 25 per cent. of the roots in the plots in which BHC was incorporated in the soil showed a constriction about 0·5 in. from the top that reduced the diameter to a half or

quarter of its normal size. The flavour of roots from these plots was still tainted when they were cooked ; the others were normal.

Second-generation adults began to emerge on 29th August, and on 3rd September, one half of each test plot at Chilliwack was dusted with 0·5 per cent. γ BHC at 0·5 lb. per 100 ft. of row. The plots were examined on 20th–21st October, when the percentages of carrots infested in the areas that had not received the additional treatment and (in brackets) those that had were 83·4 (62·6) for crude naphthalene, 83·3 (68·6) for moth balls, 23·8 (12·6) for the BHC soil treatment, 28·8 (16·9), 23·1 (8·2) and 16·5 (1·3) for 1, 2 and 3 BHC foliage treatments and 75 (31·5) in the controls. Except in the plots that received BHC, some second-generation damage may be included in these estimates, as it was difficult to distinguish between the injury caused by the two generations, and that would account for the high rates of infestation. A similar additional BHC treatment, but at half the rate, was made at Sardis. The plots had been partly destroyed, but the results, where available, conformed closely to those at Chilliwack. Late-sown carrots treated with BHC in early September did not become infested by third-generation larvae.

JANNONE (G.). **Studi e ricerche di entomologia agraria in Etiopia e in Eritrea. I. Osservazioni su** *Tanymecus abyssinicus* **Hust. (Col. Curcul.) condotte in Etiopia e in Eritrea dal 1939 al 1945.** [Studies and Researches on agricultural Entomology in Abyssinia and Eritrea. I. Observations on *T. abyssinicus* in Abyssinia and Eritrea from 1939 to 1945.]—*Riv. agric. subtrop.* **41** no. 1–3 pp. 43–54, 1 fig., 12 refs. Florence, 1947.

The author records that adults of *Tanymecus abyssinicus*, Hust., caused serious damage in the second half (rainy season) of 1939 to seedling maize and sugar sorghum at an experimental farm near Addis Ababa, Abyssinia, in July 1943 to almost mature hybrid maize between Asmara and Adi Ugri, in Eritrea, and between November 1944 and February 1945 to young grain sorghum and *Pennisetum typhoides* at two places in Eritrea near the Sudanese border. In experiments at the farm, repellents were tested, as it was feared that a lead-arsenate spray would scorch the seedlings, and the best results were given by dusting the plants with a mixture of sulphur and naphthalene (1 : 1), repeated at intervals of three days on account of the rains. On the hybrid maize, a spray of 0·05 per cent. lead arsenate gave 85 per cent. mortality, and a second application proved unnecessary ; a poison bait of bran with 2 per cent. sodium arsenite was ineffective. The literature on the habits of the genus and other species of it that occur in Africa is briefly reviewed.

COTTIER (W.). **Experiments on Control of Dicky Rice Weevil (***Maleuterpes spinipes* **Blkb.), Leafrollers and the Mealy-bug (***Pseudococcus longispinus* **Targ.) on** *Citrus*.—*N.Z. J. Sci. Tech.* **29** (A) no. 6 pp. 276–283, 2 figs., 1 ref. Wellington, N.Z., 1949.

Adhesive bands are used to control *Maleuterpes spinipes*, Blkb., on *Citrus* in New Zealand [*R.A.E.*, A **31** 454], but are not wholly satisfactory, since they do not cause direct mortality, their use necessitates keeping the ground beneath the trees free from herbage and trimming the lower branches, and occasional cases of injury have been reported where, contrary to recommendation, the bands have been kept on the same part of the trunk for several years. Experiments were therefore carried out on the value of sprays of lead arsenate, cryolite, DDT and BHC (benzene hexachloride) against this weevil and other insects. In 1945–46, sprays were applied to orange trees six times between 6th December and 28th February, and adhesive bands were placed round the trunks of other orange trees on 6th December and freshened up on the date

of each subsequent spray application. The percentages of fruits damaged by the weevil and (in brackets) leafrollers [*cf.* **28** 153] were 0 (0) for 10 lb. 10 per cent. p,p′ DDT powder with a wetter, 0·4 (19·3) for 5 lb. 10 per cent. crude BHC powder (0·06 lb. γ isomer) with a wetter, 2·5 (6·6) for 2 lb. lead arsenate with a wetter, and 0·2 (13·7) for 2 lb. cryolite and 2·5 quarts summer oil, all per 100 gals. water, 0·6 (30·8) for banding and 19·5 (36) for the control. DDT was clearly the best treatment in both cases ; cryolite, BHC and banding were significantly superior to lead arsenate against the weevil, with no significant differences between them, and lead arsenate was significantly better than cryolite and BHC against leafrollers, though all three gave significant control. None of the treatments significantly reduced the percentage of fruits showing sooty mould due to infestation by *Pseudococcus adonidum*, L. (*longispinus*, Targ.), and lead arsenate increased it significantly. BHC tainted the fruit. In 1946–47, sprays of 0·1 or 0·05 per cent. p,p′ DDT with the wetter gave complete protection from the weevil and complete or virtually complete protection from leafrollers, whether applied twice (3rd December and 3rd January) or more frequently, while the percentages of fruit injured, with those for the leafrollers again in brackets, were 12·2 (8) and 2·4 (10) for the cryolite spray applied twice (3rd December and 3rd January) and three times (3rd and 27th December and 20th January), 3·4 (25·1) for a paint containing 5 per cent. DDT applied to the trunks on 3rd December and 3rd January, and 26·4 (9·7) in the controls. DDT sprays were again superior, but the paint and three (but not two) applications of cryolite gave significant protection against the weevil.

Cottier (W.). **Resistance of Dwarf Beans to Field Infestation by Bean Weevil (*Bruchus obtectus* Say).**—*N.Z. J. Sci. Tech.* **29** (A) no. 6 pp. 284–286, 2 refs. Wellington, N.Z., 1949.

Since earlier work in New Zealand had indicated that dwarf beans exhibit varietal resistance to field infestation by *Bruchus obtectus*, Say [*R.A.E.*, A **35** 419], seeds harvested in 1946 from plants of ten varieties that had been equally exposed to infestation by this Bruchid while growing were placed in glass jars with insect-proof covers and examined for infestation after an interval of about a month and again three months later. The results, which are given in a table, showed that the mean numbers of Bruchids that emerged per 100 seeds and the mean percentages of seeds injured varied considerably on each date, and the differences were in some cases significant. The order of varietal resistance was approximately the same at the two examinations and as that found in the earlier experiments.

Chamberlain (E. E.) & Matthews (R. E. F.). **A Virus Disease of Docks in New Zealand.**—*N.Z. J. Sci. Tech.* **29** (A) no. 6 pp. 286–291, 2 figs., 3 refs. Wellington, N.Z., 1949.

Plants of dock (*Rumex*) showing a mosaic mottling of the leaves have been observed in parts of New Zealand for many years and were found in association with rhubarb with similar symptoms during a survey in 1941. It was thought that the same virus might be responsible in both cases. Experiments showed that the virus from dock, which occurs naturally in *R. obtusifolius*, *R. crispus* and *R. pulcher*, is sap-transmissible, but it could not be transmitted artificially to plants of other species, including rhubarb and sheep sorrel (*R. acetosella*) ; it was transmitted from *R. obtusifolius* to *R. obtusifolius* and *R. pulcher* by *Macrosiphum solanifolii*, Ashm., and *Myzus persicae*, Sulz. The symptoms resemble those of dock mosaic in Britain, but the viruses responsible differ in their physical properties.

BRITISH STANDARDS INSTITUTION

A Committee for Nomenclature of Pest Control Products

During the last twenty-five years, great advances have been made in the development of chemicals for pest, disease, weed and rodent control. In the past ten years in particular, many new compounds have been marketed on a world-wide scale for use in the medical, veterinary, agricultural and industrial fields. The chemical names of these compounds have in many instances been too complicated for common use, and shortened forms and trade names have been devised. As there may be several of these applied to one chemical compound, confusion has arisen in commercial descriptions of products and also in the scientific literature.

The problem was discussed at the Commonwealth Entomological Conference in 1948, and a resolution passed urging the appointment of a committee to agree common names for established compounds. The Executive Council of the Commonwealth Agricultural Bureaux referred the recommendation to the British Standards Institution, as the appropriate body in the United Kingdom to deal with the matter. A Technical Committee for Nomenclature of Pest Control Products has now been appointed by the B.S.I. and includes representatives of Commonwealth countries, Government departments, scientific societies and manufacturers' organizations. The Committee meets under the Chairmanship of Mr. H. J. Jones, A.R.I.C., who is also Chairman of the Pest Control Products Industry Standards Committee of the Institution, with Dr. Catherine Tinker, A.R.I.C., as Secretary.

The Committee's terms of reference are: "To prepare standards for the nomenclature for insecticidal and fungicidal chemicals and other pest control products." It is working in the closest collaboration with the Standards organizations in Commonwealth countries, and with the Inter-Departmental Committee on Pest Control in the United States of America. Standards organizations in other countries have been informed of the formation of the Committee and of its proposed programme, and it is hoped that it may eventually be possible to arrive at international agreement on nomenclature.

CK (PCC) 9123: *3rd February*, 1950.

COMMONWEALTH INSTITUTE OF ENTOMOLOGY.

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